A TEXT-BOOK OF HYGIENE.

DOMESTIC HYGIENE

AND

SANITARY INFORMATION,

INCLUDING ARTICLES ON

THE HUMAN BODY, DIGESTION AND NUTRITION, THE CAUSES OF DISEASE, THE EFFECTS OF INTEMPERANCE, FOOD AND DIET, CLEANLINESS AND CLOTHING, EXERCISE, RECREATION AND TRAINING, THE HOME AND ITS SURROUNDINGS, THE PREVENTION OF INFECTIOUS DISEASES, ETC.

BY

GEORGE WILSON, M.A., M.D.,

AUTHOR OF "HANDBOOK OF HYGIENE AND SANITARY SCIENCE."

EDITED WITH NOTES AND ADDITIONS

BY

J. G. RICHARDSON, M.D.,

PROFESSOR OF HYGIENE IN THE UNIVERSITY OF PENNSYLVANIA, IN PHILADELPHIA.

PHILADELPHIA:

P. BLAKISTON, SON & CO.,

No. 1012 Walnut Street.

1885.

"Hygiène is the art of preserving health; that is, of obtaining the most perfect action of body and of mind during as long a period as is consistent with the laws of life. In other words, it aims at rendering growth more perfect, decay less rapid, life more vigorous, death more remote."—PARKES.

"Only in a strong and clean body can the soul do its message fitly."—FULLER.

"Who would not give a trifle to prevent
What he would give a thousand worlds to cure?"
YOUNG.

"Houses are built to live in, and not to look on; therefore let use be preferred before uniformity, except where both may be had."—LORD BACON.

EDITOR'S PREFACE.

THE admirable manner in which Prof. Wilson has performed his task leaves little to be done by an American editor, save the addition of a few notes respecting matters wherein variations of climate, habits of life, social surroundings, and, above all, sanitary regulations in the United States, slightly modify sundry solutions to the hygienic problems so ably discussed.

His hope that the volume will be specially welcomed by parents and teachers, is amply justified by its thorough adaptation to the wants of the school room, and its exact fitness for meeting the requirements of instructors, who desire to take part in the prevailing new and excellent movement for teaching hygiene and physiology in both public and private schools. Since all human happiness depends so absolutely upon obedience to the laws of Hygiene, no more useful study than that of sanitary science can form part of the curriculum of any institution of learning, and Dr. Wilson's clear, definite, and everywhere reliable statements, render this work singularly valuable, as a Text-book of Hygiene for schools.

J. G. R.

PHILADELPHIA, April, 1885.

AUTHOR'S PREFACE.

WHEN I was requested by the Publishers to write a popular work on Health and Healthy Homes, I readily consented to do so because I believed then, as I do now, that a concise and practical treatise on this all-important subject was very much required. For although there are many excellent works which have been published of late years on health, there are very few indeed in which any attempt has been made to treat the whole subject, so far as it relates to the domain of Domestic Hygiene, in a systematic and comprehensive way. Some of them are devoted almost exclusively to a description of the various structures and uses of the organs of the human body; others to practical details concerning food and diet; others to causes of disease, and rules of life and conduct; while only a few contain special information concerning the home and its surroundings, or the prevention of dangerous infectious disease.

Now, a glance at the table of contents will, I trust, convince the reader that it has been my special aim throughout to render the work as complete in these and other respects as its prescribed limits would permit, and to present it, in accordance with the title, as a trustworthy guide to Domestic Hygiene in all its branches.

In the Introductory Chapter, I have endeavored to prove by an appeal to vital statistics, how vast is the amount of preventable disease and suffering, which still saps the foundations

of national health, and have tried to interest the reader by explaining all the more important bearings of so dry a subject in as attractive a way as I possibly could. In the Second Chapter, I have entered with sufficient fullness into the structure of the human body and the physiology and functions of its various organs, to supply all the information which need be required to understand clearly the nature of those intricate processes going on within us which constitute the miracle of life, and which are so essential to an intelligent appreciation of the laws of health. In the Third Chapter, the numerous causes of disease are explained and illustrated—whether induced by hereditary influence; by personal habits, mode of living, or mental worry and overwork; by material agents, such as impure air, bad or tainted food, and polluted water; by local causes connected with the home and its surroundings; or by so-called disease-germs, which are still so recklessly disseminated among all classes of the community. In the Fourth Chapter, the important subject of food and diet is treated, giving in detail the nutritive values of different articles of food,—including water, beverages, and stimulants,—together with a large amount of useful information concerning food constituents and the principles of dietetics, the qualities and examination of numerous articles of food, the preparation of food, and practical hints on diet in respect to age, sex, and conditions of life. In the Fifth Chapter will be found instructions with regard to cleanliness, bathing, and clothing, in their relations to health; while the Sixth is devoted to a consideration of the hygienic uses and advantages of exercise, recreation, and physical training. In the Seventh Chapter, the essentials of healthy homes and their surroundings are fully detailed; and in the Eighth Chapter, the principal dangerous infectious diseases are described, the various modes in which they are disseminated explained, and the precautionary measures for their prevention indicated. I have only to add that, without in any way interfering with the continuity of the work, I have so arranged it that each chapter may be read as a separate and distinct essay on the subject of which it treats.

How far I may have succeeded in carrying out this somewhat extensive programme with commendable precision and

completeness, I leave the reader to judge. I may, however, be permitted to say that I have avoided technicalities as much as possible, and while I have endeavored to treat every subject with all attainable accuracy, I have written avowedly for all classes of readers, and, I trust, in such a practical way as to be clearly understood without being diffuse or tedious. The book in no sense infringes on the art of curing disease, but aims solely at its prevention, by affording such information and inculcating such principles as will tend to preserve health and prolong life.

In conclusion, I venture to hope that this little work will be specially welcomed by parents and teachers, and that it will prove a reliable and readable guide to all, whether old or young, who carefully peruse it.

23, Claremont Road, Leamington.

CONTENTS.

CHAPTER I.

INTRODUCTORY.

CHAPTER II.

THE HUMAN BODY.

CHAPTER III.

Causes of Disease.

CHAPTER IV.

Food and Diet.

CHAPTER V.

CLEANLINESS AND CLOTHING.

CHAPTER VI.

EXERCISE, RECREATION, AND TRAINING.

CHAPTER VII.

The Home and its Surroundings.

CHAPTER VIII.

Infectious Diseases and their Prevention.

CHAPTER I.

INTRODUCTORY.

MANY of my readers, I have no doubt, are well acquainted with Addison's beautiful allegory, "The Vision of Mirza." Looking eastward from the highest pinnacle of the rock on which his guide had placed him, Mirza beheld a huge valley, and a prodigious tide running through it. The valley, he was told, was "the vale of misery," and the tide of water which "rose out of a thick mist at one end, and lost itself in a thick mist at the other," was but part of the great tide of eternity called Time. Peering across this shoreless ocean, Mirza then discovered a bridge standing in the midst of it, but shrouded at either end by a dark cloud, and the bridge, he was told, was human life. Being asked to survey it more closely, he found that "it consisted of three-score and ten entire arches, with several broken arches, which, added to those which were entire, made up the number about an hundred." And over the bridge he beheld multitudes passing, and several of the passengers dropping through into the great tide that flowed underneath, for "there were innumerable trap-doors which lay con-

cealed in the bridge, which the passengers no sooner trod upon but they fell through them into the tide, and immediately disappeared." He noticed further that these hidden pitfalls were set very thickly at the entrance of the bridge, so that throngs fell through them as soon as they broke through the cloud. They became fewer towards the middle, but multiplied and lay closer together towards the end of the arches that were entire, while over the broken arches there were some persons, though very few indeed, that "continued a kind of hobbling march, but fell through one after the other, being quite tired and spent with so long a walk."

Such was the opening vista in "The Vision of Mirza," and weird and shadowy though its outlines be, it represents very vividly what has been called the march of a generation through life, and the casualties under which so many succumb even in the first few stages. It is true that the trap-doors or hidden pitfalls suggest a somewhat fatalistic view of the deadly "ills which flesh is heir to," but in Addison's days, and indeed until quite recently, disease was regarded as inevitable far more than avoidable—curable it might be in some instances, but rarely admitting of prevention or control. The very few who reached the broken arches were looked upon pretty much in the same light as soldiers who had luckily escaped the shot and shell of a thickly strewn battle-field. Now, however, we are beginning to realize that most of these pitfalls may be avoided, and the trap-doors made secure and passable, so that many, instead of the ever-lessening few, may travel on towards the broken arches.

But to leave metaphor aside, and come to the dry details of figures, let us glance briefly at the casualties which befall an English generation in the various stages of its march through life. These have been very carefully and fully worked out by Dr. Farr, in one of his

recent masterly reports accompanying the Returns of the Registrar-General, and the sum and substance of them are as follows:—Out of every 1000 children born, 149 succumb on the average before the first year of life is reached, and before the age of five years as many as 263. Many die from a diseased heritage, many from starvation and neglect, and many more from diseases, such as scarlet fever, measles, and whooping-cough, which we shall afterwards see are more or less preventable. But the number of victims varies largely in different localities. Thus, in the so-called healthy districts of the country, out of 1000 born, the number of children who die in the first five years of life is 175 instead of 263; while in Liverpool, which represents the most unfavorable sanitary conditions, the number is 460, or 285 in excess of the deaths in healthy districts. Such enormous waste of infant life may truly be called appalling.

Returning now to the 737 survivors, who on the average reach the sixth year, we find that most of them have been attacked by one disease or another, and diseases of a kind which fortunately seldom recur in the same individual. So the total deaths in the following five years are comparatively few, and only amount to 35, about a fourth of which are due to scarlet fever, which still attacks some who had previously escaped. From ten to fifteen years of age, the deaths are fewer than at any other period, and only number 18. But after the age of puberty has been passed, the mortality begins to increase, especially amongst women, and consumption claims a considerable share of the death-roll; indeed, between the ages of twenty and twenty-five, nearly one-half the number who die succumb to this fatal disorder, and fever is associated with it as the great preventable disease. Melancholy suicide begins to contribute its victims, the worries and anxieties of life induce fatal brain affections, deaths

by accident among males become more numerous. insanity in both sexes looms on the horizon, and childbirth among women has its fatalities.

At twenty-five years of age, we find the number of travellers on life's journey reduced from 1000 to 634, and 62 drop off before the age of thirty-five is reached. This stage embraces the prime of life, the period of manly vigor; yet consumption still proves the most fatal disease, and more so among women. Two-thirds of these are now married, and the deaths from childbirth exceed the deaths from accident among the men. Fever, though not so fatal as it was in the previous period, causes 4 out of the 62 deaths, while consumption claims 27. Other diseases of the lungs, and diseases of the heart and brain, increase in intensity.

And here, by way of contrast, let us glance at the fate of a generation exposed to unfavorable sanitary conditions, such, for instance, as prevail in large and crowded populations like Liverpool. There, out of the 1000 born, only 434, or less than one-half, reach the age of twenty-five, and only 360 are alive at thirty-five; whereas in healthier districts as many as 727 live to the age of twenty-five, and 667 survive ten years longer.

Between the ages of thirty-five and forty-five, the 572 survivors at the former age are reduced by 62; and now we come to the middle arch of life, when the ranks are thinned of one-half their number. A few months after the age of forty-five is reached the 1000 lives are reduced to 500, and when fifty-five is reached the numbers are still further reduced to 421. The passing generation has now produced the succeeding generation. Many of the structures begin rapidly to give way. Consumption still holds its fatal prominence, while lung diseases, heart diseases, brain diseases, and liver diseases are becoming more common and deadly. Fever continues to claim its

victims, deaths by accident are not uncommon, suicide is slightly on the increase, and cancer (especially amongst women) begins to swell the death-roll.

From the age of fifty-five and onwards, the numbers thin with increasing rapidity. Out of the 421 who enter this stage of life, only 309 reach the age of sixty-five, and 161 the age of seventy-five. Diseases of the lungs destroy the largest number of lives. Many die from heart disease, brain disease, and diseases of the liver and bowels. Intemperance and disregard of the laws of health claim their later and larger harvest. Cancer becomes increasingly fatal amongst women, and not a few of both sexes die of no well-defined disease, their deaths being attributed to debility or old age. The few remaining pilgrims have at last reached the broken arches described in "The Vision of Mirza." Only 38 out of the 1000 reach the age of eighty-five, and one by one they continue to drop through, "being quite tired and spent with so long a walk." The wheels of life are run down, and the greater number sink to rest calmly and placidly "after the fashion and semblance of a kindly and pleasant sleep." At the age of ninety-five, but 2 survive out of the 1000, while only one out of every 4000 born reaches the age of one hundred.

And what, it may be asked, are the inferences to be drawn from these figures, and the various casualties which they represent? In the first place, it will have been noticed that the mortality at different ages is largely influenced by the sanitary surroundings and conditions of the people. In densely crowded towns, for example, the average duration of human life sinks to nearly half the standard of healthy districts; and this is the result of the enormously increased mortality among children under five years of age, and the excessive mortality in

youth and manhood up to the ultimate term of life, but few reaching and few surviving the "three-score years and ten." It will be seen also that certain diseases prove very fatal in certain epochs, and that others, though common to different epochs, are far less destructive at some periods of life than at subsequent periods. Thus, measles, whooping-cough, and scarlet fever are essentially fatal during childhood; while diseases of the lungs, though common to this period, become increasingly fatal as old age creeps on. But without proceeding further with this analysis, and leaving the facts and figures which have been given to tell their own tale, the question arises, what may reasonably be supposed to be the natural term of a man's lifetime? Not a few of the alchemists of the Middle Ages, and some philosophers of more recent times, such as Descartes and Franklin, believed that human life could be prolonged indefinitely, and we read of men wasting their years and shortening their lives in trying to discover an *elixir vitæ*, which would ensure immortality on earth, and a manhood of perpetual vigor and strength. But delusions like these have long since been dispelled by the plain teachings of science, and we now know that though life may be prolonged by careful regimen and obedience to the laws of health, a time comes in the history of every individual, however long-lived he may be, when vital energy becomes powerless to resist the stealthy progress of decay, and the body sinks at last into the cold bosom of mother Earth.

As regards the length of this period which intervenes between birth and natural death, statistics help us to make only an approximate estimate. Dr. Farr, who is perhaps better able than any other authority to give an opinion on this point, has estimated the natural lifetime of man to be a hundred years; and certainly, when it is

remembered that some few well-authenticated instances are recorded in which the lifetime of a century has been exceeded, and many are known in which it has been approached, this estimate cannot be regarded as excessive. Be this as it may, old age may be said to commence at about sixty, with some a little earlier, with others a little later, and even though there be a continued freedom from disease, the bodily powers gradually and imperceptibly begin to wane, the step becomes less elastic, the heart beats more slowly, the digestion becomes weaker, the breathing shallower, until at last, after a varying period, the natural life terminates in natural death. Frequently the intellectual faculties retain their vigor long after the bodily powers begin insensibly to decline, but by-and-by they too show signs of decay. Recent events are readily forgotten, and passing incidents are strangely linked with newly awakened memories of long ago. The inclination to sleep becomes stronger and stronger, and the periods of wakefulness shorter and shorter, until at length the sleeper has drifted painlessly and peacefully into the sleep that knows no awakening. This is the true Euthanasia —the natural death, which completes the cycle of natural life.

We now pass on to the consideration of some further statistical details which will be of service in enabling the reader to appreciate the value and significance of the stated returns of the Registrar-General which find a place in the leading daily journals, and of the reports of medical officers of health throughout the country which appear from time to time in local newspapers.

It will be inferred from the previous remarks that very few die from old age; almost all, including even old people, succumb to some particular kind of disease. As we shall see subsequently, the disease may be inherited, or it may be self-inflicted by vicious habits or carelessness,

or it may be produced by local causes, or it may be the result of exposure to infection; but whatever the cause, the more closely the sequence of events is scrutinized, the clearer it becomes that a very large proportion of deaths is attributable to influences brought into operation by man himself, and therefore more or less under his control.

Now, it is the special province of what are called vital statistics to enable us to arrive at reliable conclusions, based on numerous well-ascertained facts, concerning everything which affects the health and well-being of the community. Ever since the days of Queen Elizabeth, births, deaths, and marriages have been partially registered in the different parishes throughout England; but it was not till 1837 that the Legislature passed an Act which provided that for the future all these entries should find a place in a national register, and that as regards deaths, the various causes or diseases should be certified by the medical attendant. That the important office of the Registrar-General of England, which was established by that Act, has been productive of a vast amount of benefit to the health of the nation, and indeed has largely stimulated other countries to follow in the wake of sanitary progress, there can be no doubt. By means of the statistics which are forwarded regularly to the central office from all parts of the country, the mortality in different localities from various diseases and at different ages can be readily compared, and the relationship to sex and occupation can also be determined. But in addition to the reports of the Registrar-General, which are of national interest, the Public Health Act of 1872 inaugurated another and more intimate kind of sanitary supervision, by the appointment of medical officers of health alike in towns and country districts, whose reports, bearing on the vital statistics of their several districts, are of local inter-

est and concern.* In order that the inferences or deductions which are based on these statistics may be fairly accurate and reliable, it is of course necessary that the number of the population should be known or approximately estimated. This is ascertained positively every ten years by census, and for the successive intervening years it is calculated by adding the known yearly rate of increase which has taken place in any town or district, while as regards the estimate of the general population of the kingdom, other corrections have to be made in respect to emigration and immigration.

Generally speaking, the vital statistics which may be taken as an approximately fair index of the sanitary condition of any locality are—the total death-rate, the death-rate from so-called zymotic disease, the infant mortality rate, and the percentage of deaths of children under five years of age. Of course, there are many other problems which may be worked out, such as the death-rate from any particular kind of disease—as, for example, cancer, consumption, or heart disease, or the average age at death of those employed in different trades and occupations; but these are the most important.

What is called the total or gross annual death-rate of any locality is calculated on the number of the population living, without distinction of age or sex, and is expressed as so many per 1000. The zymotic death-rate is based on the number of deaths which are attributed to the seven principal zymotic diseases, namely, small-pox, measles, scarlatina, diphtheria, whooping-cough, fever, and diarrhœa, and is also expressed as so many per 1000 of the population. And here it may be explained that

* This invaluable care of the public health, which constitutes one of the most important functions of a wise and enlightened government, has been sadly neglected in the United States. As yet a few of our commonwealths only have active and efficient Boards of Health, but it is to be hoped that legislators throughout the country, will soon discern and remedy this lamentable omission.—(R.)

the term "zymotic" is applied to those diseases which are believed to be propagated by infective germs which develop as ferments in the body of the person infected, and give rise to all the symptoms of the special disease. The term is derived from a Greek word *zume*, signifying a ferment, and the theory is that these germs or particles, although they are too minute to be detected by the most powerful microscope, bear a strong analogy to the cells of the yeast plant, which are capable of being transmitted from one tumbler of saccharine substance to another, and of growing and multiplying in that substance. It is true that all this is mere hypothesis; but we do find practically that many diseases are propagated very much in this way. The contagion of small-pox, for example, has often been wafted from one side of a street to another, and both it and scarlet fever are frequently spread by articles of clothing which have been infected by tainted air in one house, and conveyed, it may be, long distances, to some other, in the ordinary intercourse of life.* The infant mortality rate is usually measured by the proportion of deaths of infants under one year to births registered, and is also expressed as so many per 1000, or it may be expressed as a percentage of the total number of deaths.

The mean annual death-rate for the whole of England and Wales during the ten years 1861–70 was 22.4 per 1000; but it need hardly be said that it varied very considerably in different localities. Thus, in fifty-four registration districts the mortality was at the rate of only 17 per 1000, and in a few it was as low as 15. In another series of districts it was 19, and gradually increasing pretty much according to density of population, to 22 and 25, it reached in Manchester a rate of 32.5, and in Liver-

* See editor's lecture on "The Germ Theory of Disease and its present Bearing upon Public and Personal Hygiene." *Penn Monthly* for Nov., 1878.—(R.)

pool it reached the enormous rate of 38.6 per 1000. The significance of these figures becomes all the more manifest when it is remembered that, had the average death-rate of the whole of England and Wales been the same as that which prevailed in the healthy districts, namely, 17 per 1000, there would have been an annual saving of 115,000 lives. But even in the so-called healthy districts there are numerous local causes of disease which still call for removal, so that the estimate of 120,000 lives sacrificed annually to insanitary conditions and neglect of ordinary precautions cannot be considered to be by any means excessive. When, moreover, we reflect that many diseases which terminate fatally are induced, not by local causes or exposure to infection, but by disobeying the ordinary laws of health or the rules of domestic hygiene, it will become at once apparent that this estimate large, though it be—amounting, indeed, to about one-fourth of the average annual death-rate—falls very far short of the mark in giving any adequate idea of the vast amount of preventable human suffering which is scattered broadcast throughout the country.

Let us now glance at the death-rate from the seven principal zymotic diseases which have already been enumerated. During the year 1878, it amounted to 3.3 per 1000 persons living, and represented a total of over 82,000 deaths. Now, almost all these deaths were due to local conditions of filth and nuisance polluting air and water, or to reckless dissemination of contagion by so-called disease-germs, and both these wide fields of disease-causation can be greatly lessened by carrying out the provisions of the Public Health Act in securing healthier homes and more cleanly surroundings, and in adopting adequate precautionary measures against the spread of infectious disease.

The zymotic death-rate in healthy districts ought not

to exceed 1 per 1000, and in institutions under proper sanitary control it is practically *nil*.

With regard to the infant mortality rate, it has been previously shown that during the ten years 1861–70 the average annual number of infants who died under one year of age was 149 out of every 1000 births, ranging from about 100 in the healthiest rural districts to over 250 per 1000 births in some of the unhealthiest towns. It has also been shown that in the healthiest districts only 175 children die in the first five years of life out of every 1000 born, whereas in Liverpool as many as 460, or nearly one-half the number born, succumbed before they reached the age of five. No doubt many of these deaths are due to culpable neglect on the part of unmotherly mothers, to ignorance in feeding, to hereditary debility, as well as to local causes; but the vast difference in the rate of mortality in different localities proves how enormous the saving of infant life would be if proper care and healthy conditions could alike be secured. Hitherto, unfortunately, a high death-rate among infants has been regarded as inevitable among the poorer classes in our large towns; but the results of the efforts of building societies for improving the dwellings of the laboring classes have already proved beyond all doubt that, when properly housed, the death-rate among such families can be reduced by more than one-half. As an illustration of the effects of sanitation in reducing the death-rate among children, I may refer to the admirable address delivered by Mr. Edwin Chadwick at the Social Science Congress held at Aberdeen, in the autumn of 1877, in which he states that in several large pauper asylums for children between the ages of three and fifteen, the mean death-rate has been steadily reduced to 3 per 1000, or to less by two-thirds of the death-rate prevalent amongst the general population of the same ages.

Without commenting further on the subject of vital statistics and the lessons which they teach, I may here append a few other examples of the results of sanitation deducible from normal instances, which have been summed up by Mr. Chadwick in the same address, and they are these:—

1. That we have gained the power of reducing the sickness and death-rate in most old cities by at least one-third, or to 16 or 17 per 1000 of the population.

2. That in new localities with healthy dwellings, properly constructed drainage, and a pure water supply, we may reasonably look forward to ensuring a death-rate of only 10 per 1000, or less than one-half of the present average death-rate.

3. That in well-provided and well-regulated institutions for children, and in prisons and other places under effective sanitary control, the death-rate is not only enormously reduced when compared with that of the general population of the same ages, but a practical immunity can be secured against zymotic diseases.

4. That amongst the general population a reduction by full one-half of diseases of the lungs may be effected by general public sanitation.

Other examples are given, but these are sufficient to show how controllable is the general mortality rate, and what a vast amount of disease and suffering may be prevented by public and private hygienic measures when fully and intelligently carried out. But there are some people who argue that, because the general death-rate has with slight fluctuations remained stationary at a little over 22 per 1000 for years back, sanitary improvements and sanitary knowledge are alike powerless to combat against the death-roll entailed by over-crowding and over-population. Concerning over-population theories this much may be said—that, thanks to free trade and ex-

tended commerce, the people of this country are no longer dependent upon home products for home consumption. We largely supplement our own supplies of food from other countries, and when the time comes we have still many waste lands left which could be made fruitful and productive. But with regard to the possibility of lowering the general death-rate and prolonging the average duration of life, there is no doubt. For example, the death-rate in London has been lowered from 80 per 1000 in the seventeenth century to 50 per 1000 in the past century, and to 24 per 1000 at the present day. Then, again, we find, during recent years, that improvements in drainage and water supply have been followed by a very considerable lowering of the death-rate in many other towns throughout the country. Thus, from 1841 to 1870, the death-rate has been lowered in Salisbury from 28 to 20 per 1000; in Coventry from 27 to 21 per 1000; in Hull from 31 to 26 per 1000; in Macclesfield from 26 to 23 per 1000; and in Wolverhampton from 27 to 24 per 1000. It is true that these reductions have been counterbalanced by increased death-rates in other towns, mainly attributable to the evils attendant on over-crowding, against which no legal enactments had been passed until within the last few years, but they prove conclusively that the argument of the impossibility of lowering the general death-rate is untenable. The results of sanitary legislation and local administration have not yet had time to declare themselves in many of our large towns, because the evils to be combated were so enormous. But recent statistical returns show that even in Liverpool, Manchester, Sheffield, and other localities where vast populations have been huddled together, there are hopeful signs of amelioration. At the same time, it must not be forgotten that in over-populated towns, and indeed elsewhere, there are other causes of disease not under administrative

control, which contribute largely to the death-roll; but these will be more conveniently considered in a separate chapter.

Meanwhile, it is encouraging to note that steady progress is being made in establishing and carrying out sound principles of sanitation throughout the country generally. The period of half-knowledge and painful experimentation has gone by, and we can now say we know the nature and extent of the work which lies before us; we know every day more fully the principles and details which should guide us in carrying it out; and, what is more, we can rely more safely and surely upon the steady growth of intelligent conviction, which, proceeding from the press and public platform, is rapidly influencing all classes of the community, and enlisting their services in the grand policy of prevention. Nor should I omit to refer to the benefits which must ultimately accrue from the greater attention which the teaching of physiology and the laws of health is year by year receiving in our schools. This in itself is an influence which is only now beginning to be appreciated, but which will doubtless, and at no distant date, operate largely in the preservation of health and in the prevention of human suffering. For, after all, the real groundwork of national health is the knowledge which teaches how personal health may be best secured and maintained; and this is the aim and scope of domestic hygiene.

CHAPTER II.

THE HUMAN BODY.

In order to acquire a practical knowledge of the laws of health, it is very essential that people generally should know something of the structure of the human frame, and more particularly of the various intricate processes going on within us, which constitute the miracle and mystery of life. Now, it is apparent at the outset that the living body performs a great variety of actions, some of which are so obvious that they need barely be alluded to, while others require the closest observation and the minutest scientific research. Thus the body can perform a certain amount of work like a machine; and even when we sleep, some parts of it are always in motion, as shown by the regular heaving of the chest and the beating of the heart. Then, again, we know that the body is always warm and gives off heat; we know, too, by breathing against a pane of glass, that it gives off moisture; and if we breathe into lime-water, we find that the lime-water speedily becomes milky from the precipitation of carbonate of lime, showing that carbonic acid gas is also given off by the breath. If, moreover, we weigh the body of a living man very carefully, and set him to do some active work for an hour or so, we find, on again weighing him, that he has lost weight—provided, of course, that he has taken no food or drink in the interval. Thus, it is made clear that an active man exerts mechanical force, gives off heat, gives off moisture and carbonic acid, and loses substance; and in order to keep this living machine and

its various processes going, it is necessary that the body should be supplied with three things: fresh air, food, and water. Every part of the body is constantly undergoing waste, and this waste is being constantly renewed by the three essentials just named. Having thus glanced briefly at the working of the machine, let us now proceed to consider its structure, and its relations to dead and living matter.

I. Chemical Composition.

In the world around us, matter may be said to exist in the four following phases:—(1) The elemental stage, or the stage of irreducible matter; (2) the mineral stage, or the stage of chemical compounds; (3) the vegetable stage, or the vegetable world; and (4) the animal stage, or the animal world. The first two stages are comprised in what is called the inorganic world, or world of dead matter; and the last two make up the organic world, or world of living matter. The first, or elemental stage, is so called because it includes the various substances found in the earth or its atmosphere, which cannot be reduced into simpler forms, and altogether they amount to over sixty in number. A few of them are gaseous, such as oxygen, hydrogen, nitrogen, and chlorine; but most of them are solid, such as iron, carbon, sulphur, phosphorus, calcium, sodium, and magnesium. If we further examine into the relationships which subsist between these several phases of matter, we find that the first or elemental stage is converted into the second by what is called chemical force, while the first and second stages are converted into the third, and the third into the fourth, by what is called vital force.

But what is vital force? Is it a separate entity which may be regarded as the efficient cause of the production and maintenance of every living organism, irrespective

and totally independent of other forces, such as heat, light, and electricity, which operate in the inorganic world? We have no reason to believe so. Indeed, the more one studies this mystery, the more is the mind driven to the conclusion that vital force, though not identical with, is inseparable from, the ceaseless cycle of energy which pervades the universe. We find that the germ of a plant or animal is a mere microscopic mass endowed with a mode of activity, so to speak, which enables it under suitable conditions to develop into a semblance of its parent, to produce other germs like itself, and to resist external destructive agencies for a certain period; and it is this mode of activity which is known as vital force. But this is not the real organizing force of either the plant or the animal. In both cases the organizing force is heat, the heat originally derived from the sun. The germ, therefore, may be said to supply directive energy, but not constructive force. Just as chemical affinity cannot raise matter from the elemental to the mineral stage without the aid or development of heat, so we find that the mineral stage cannot be raised to the vegetable, nor the vegetable to the animal stage, without the aid of this constructive agency. But although there is this intimate relationship between physical and vital force, it scarcely admits of dispute that life, after all, is a special endowment which cannot be originated by any physical agencies, nor imparted except by inheritance. Whether it be plant or animal, there must be parentage, and when life becomes extinct, the elements which enter into the composition of the body gradually disperse and enter into new combinations.

Altogether about seventeen of these elements have been discovered in the human body, but many of them exist only in very minute quantities. Those which constitute by far the largest proportion are the four gases already

mentioned, namely, oxygen, hydrogen, nitrogen, and chlorine; while of the solid elements, calcium, sodium, magnesium, carbon, sulphur, and phosphorus are the most plentiful. It need hardly be said that they are all derived from food and drink, and they are variously combined to form compounds, of which water is the most abundant, for it forms more than two-thirds of the weight of the whole body, and water is a compound of oxygen and hydrogen. What is called protoplasm, or the formal basis of life in plants as in animals, is composed of the four elements, oxygen, hydrogen, carbon, and nitrogen, and in its simplest form appears as a cell. It is termed an albuminous compound, and as it exists in the germ so it continues to exist, though variously modified, in every part of plant or animal. In plant life, the albuminoids are exemplified by the gluten of flour, and in animal life by the albumen of white of egg, the fibrin which is constantly present in the blood, and the gelatin which is derived from boiling down bones or tendons. Besides the albuminous, or nitrogenous, compounds, the other principal organic compounds which are found in the human body are the fatty, or oleaginous; and the saccharine, or farinaceous. Both of them consist of the three elements, oxygen, hydrogen, and carbon, but without the nitrogen, and hence they are frequently designated non-nitrogenous substances. Amongst the inorganic compounds are water, already referred to, carbonic acid, and ammonia, together with the various compounds of the alkalies and alkaline earths, such as lime, potash, and soda, which are found in bone and other tissues.

II. Food Constituents.

Without entering more minutely into the chemical composition of the human body, it will be readily inferred

from these brief remarks that the materials which are required by animals for the development and maintenance of their fabric are of two kinds, namely, the organic and inorganic. The organic alone are generally regarded as foods, but the inorganic are none the less necessary for bodily sustenance, and fortunately they are found to be present in all the ordinary articles of diet, and mostly in the requisite proportions, whether these be derived partly from the animal and partly from the vegetable world, or exclusively from the latter. With the exception of a portion of the water and common salt required for the system, the other inorganic constituents of food are found mixed up with the organic constituents, which have been prepared in the first instance in the vast laboratory of the vegetable world under the vivifying influence of the sun's heat, or have become modified in the tissues of other animals before they become the food of man. Whilst plants subsist on inorganic, or mineral, compounds, the principal of which are water, carbonic acid, and ammonia, animals subsist directly or indirectly on the organized materials which are formed in the tissues of plants, and resolve them again into these simple compounds. In other words, the life of the plant ends where that of the animal begins, and the life of the plant begins where that of the animal ends. Viewed in this light, therefore, the human body is the turning point of a stream of matter which flows incessantly from the mineral and vegetable worlds, and eddies back into the mineral world again.

If we further subdivide the constituents of food, we find them arranged, as already described, in the following groups—namely, the nitrogenous, or albuminous; the fatty, or oleaginous; the saccharine, or farinaceous; and, finally, water and saline substances. Every article of diet which contains nitrogen—and the great majority of articles, as will be seen subsequently, in the chapter on

food, contain it in greater or less abundance—supplies some albuminous compound, whether it be fibrin, as in animal food; casein, as in milk and cheese; albumen, as in eggs; gluten, as in bread; or legumen, as in peas and other vegetables. All these albuminous compounds are remarkably uniform in composition, and as they each seem capable of being reduced by the digestive process to a like condition, they can replace each other in nutrition, though perhaps not to an equal extent. They are essentially muscle-forming foods, although they contribute also to the construction and repair of other tissues of the body, and assist in the maintenance of bodily heat and the display of bodily vigor.

The fatty, or oleaginous, constituents are represented by the butter in milk, the fat in butcher's meat, and the vegetable oils. They play a very important part in the maintenance of animal heat, and by their oxidation in the blood, as will be subsequently shown, they generate to a large extent the force which is rendered apparent in locomotion or manual labor. Moreover, the distribution of fat in the tissues gives rotundity to the form, serves to retain bodily warmth by its non-conducting properties, and greatly facilitates the working of the various parts of the living machine by lessening friction, and preventing jarring by its elasticity.

The saccharine, sugary, or farinaceous constituents comprise starch (which is found in rice, potatoes, and other vegetable foods) and sugar. As their chemical composition is somewhat similar to that of the fatty constituents, they exercise similar functions, and are directly subservient to the maintenance of animal heat and the production of animal force. But their heat-producing powers are much inferior to those of fat, and hence we find that while fat is largely consumed by the inhabitants of cold countries, rice and other farinaceous foods are sufficient

for the maintenance of bodily heat in warmer climes. By the process of digestion, they can be converted into fat in the system, and hence it is that persons who are prone to obesity are warned by the physician to indulge sparingly in bread, sugar, rice-puddings, and the like.

The part which water plays in the animal economy is one of the highest importance. As already stated, it constitutes nearly two-thirds of the weight of the whole body, seventy-nine per cent. of the blood, eighty per cent. of brain and muscle, and ten per cent. even of bone. Its main functions are the solution and conveyance of the other food constituents to different parts of the system, the removal of effete products, the lubrication of the tissues, the equalizing of the body's temperature by evaporation, and the regulation of the various chemical changes which take place in the processes of nutrition and decay. The supply of water for these purposes is derived from what we drink as fluid directly, or from what we take in the ordinary articles of diet, all of which contain water in varying quantities. The amount of water required by man, over and above what he obtains in food, need rarely exceed forty ounces in the twenty four hours, but a much larger quantity is consumed by most people in beverages and other drinks, and in proportion to the excess, the greater is the strain thrown on the excretory organs, especially on the kidneys. But, important though the quantity be, it is of still greater moment that the quality should be above suspicion, and unalloyed by any deleterious ingredients. If, for example, it be over-charged with saline matters, injurious results will follow sooner or later; or should it be polluted with filth or decaying animal matter, ailments of the gravest description will in all likelihood be induced. The purity of our water supplies, therefore, becomes a question of the deepest concern in the maintenance of the general health of the community.

With the exception of common salt, the saline constituents of food, as previously stated, are contained in the ordinary articles of diet, and for the most part in the requisite proportions. They exercise important functions in the digestion and assimilation of the other food constituents, and in the removal of effete matters. Some of them, such as the earthy phosphates, and especially the phosphate of lime, are indispensable to the consolidation of tissue; for not only are they present in the bony structures of the body, but they also enter into the composition of flesh. Common salt plays such an important part in the animal economy that, though it does not enter into the composition of any of the tissues, it is a large constituent of every one of the secretions, and forms about half the total weight of the saline matters contained in the blood. Then, again, the oxides of iron ought to be mentioned, inasmuch as they are largely concerned in the processes of sanguinification, or blood-making, and oxidation. They enter into the composition of the blood-corpuscles, and indeed the coloring matter of the blood, as well as that of the muscles, is a compound of iron and albumen, which possesses the wonderful property of absorbing oxygen when exposed to the air, and giving it out again in the presence of reducing agents. In the one case it assumes a bright florid hue, as in arterial blood, and in the other a dark, muddy-looking tint, as in venous blood.

With regard to the functions of those accessories of food called condiments, such as mustard, pepper, sauces, and the like, but little need be said. For the most part they are merely stimulants of the digestive organs, and in this respect aid in the process of digestion, while, by giving flavor to the food, they render it more palatable and whet the appetite. The functions of alcoholic drinks and beverages will be considered further on.

That all these four classes of food constituents should

be present in a well-arranged dietary is alike taught by experience and proved by experiment. No single class is capable of sustaining life by itself, although it has been ascertained that health may be maintained for some time on a diet containing the albuminous, fatty, and saline constituents. The absolute quantity and proportions of each which are requisite for healthy bodily sustenance varies so much according to age, sex, employment, and other conditions, that it would be useless to attempt to lay down any standard which should apply to every particular case; but for an averaged-sized adult, performing a moderate amount of work, the following quantities of water-free food are required during the twenty-four hours:—Albuminous substances (albuminates), 4½ ounces; fatty substances, 3 ounces; saccharine, or farinaceous, substances (carbo-hydrates), 14 ounces; and saline matters, 1 ounce.

III. The Tissues.

What are called the tissues of the human body are those constituent parts which are capable of being separated by the hand and skill of the anatomist. Thus, covering the whole of the body is the skin, or integumentary tissue, and this again is continuous at the various openings into the body with a more delicate membrane, which lines all the internal canals, or cavities, and is called the mucous membrane. Both the skin and mucous membrane are largely made up of a fibrous substance, named connective tissue, because it is the great connective medium by which the various parts of the body are held together. Passing from the skin it ensheaths all the muscles, covers all the bones, cartilages, nerves, and blood-vessels, and finally becomes united to the lining membrane of the internal cavities. It varies very much in character—sometimes soft and elastic, as in blood-vessels and nerves;

at other times being dense and unelastic, as in the ligaments which bind the joints together, and the tendons which join the muscles to the bones. In its delicate meshes fat is deposited in little cells in various parts of the body, and it envelops and interpenetrates all the different organs, such as the lungs, liver, and kidneys.

The skin itself is composed of two layers: the upper, named the cuticle, or epidermis, and the lower, the dermis, or true skin. The epidermis consists of a mass of flattened cells, packed closely together; while the dermis, or true skin, consists of fibres of connective tissue, and a meshwork of minute blood-vessels and nerves. These are convoluted in the so-called papillæ, or ridges, which are observable all over the surface of the skin, but are more numerous and marked on the palms of the hands and the soles of the feet. Between the papillæ there are numerous minute canals leading to small glands, called the sweat-glands, which are intimately connected with the convoluted capillaries, while there are numerous other glands, named sebaceous glands, which secrete an oily substance to keep the skin soft. The numerous nerve-filaments, as will afterwards be shown, are subservient to the sense of touch, and the meshwork of blood-vessels, glands, and ducts play a most important part in secretion. The hair and nails are appendages of the skin, and, like the epidermis, consist only of flattened or elongated cells.

Immediately beneath the skin and the layer of fat which is generally found imbedded in the connective tissue, we come upon the muscular tissue, which forms the great bulk of the human frame, and is generally recognized as "flesh." It is arranged in large bundles of fibres, which are bound together as already described, and these again are made up of smaller bundles. These bundles are arranged in masses of various sizes and shapes, ensheathed in connective tissue, and known as the muscles,

which are united at either end to the bones by the tendons. The muscles, under the influence of nervous stimulus, have the power of contracting, or becoming shorter; and it is by reason of this property that muscular tissue becomes the great motor agent of the body. By means of their separate and combined action, the bones, which constitute the levers of the body, are moved in various directions, giving rise to all the phenomena of locomotion, manipulation, and the like. Muscular action is well exemplified by what takes place when a person bends up his arm. By grasping the upper arm it is observed that, as the forearm is gradually drawn up, a large soft mass, which lies at the fore part of the upper arm, hardens and becomes prominent. This mass is known as the biceps muscle, which at its upper extremity is joined to the bones near the shoulder-joint, and at its lower to one of the bones of the forearm, near the elbow-joint. When this muscle, therefore, is called into action, that is, when it contracts, it necessarily pulls the forearm towards the shoulder; and when the arm is again extended, after the muscle has ceased to act, it is found that the swelling and hardness which became apparent during its contraction have disappeared.

The bones, which constitute the skeleton or framework of the body, are in reality masses of connective tissue hardened or petrified by deposits of phosphate and carbonate of lime. They are traversed by very minute openings, through which numerous blood-vessels ramify and nervous filaments are spread. In early life they consist largely of cartilaginous matter, and consequently are more pliable, elastic, and possessed of greater vitality; but in old age the earthy matter predominates, there is less vitality, and injuries such as fractures become more difficult of repair. Some of the bones, such as those of the skull, are specially designed for the protection of important organs contained

within them; but by far the greater proportion of them are constructed and arranged with a direct reference to motion. When one considers the wonderful variety of movements required from man, it will at once be inferred that the levers which render these movements possible must be very numerous; and, indeed, they amount altogether to over 200. All these bones are fastened together by ligaments, or cartilages, and where they move freely on one another, a coat of cartilage furnishes the surfaces which come into contact; while the numerous joints which are thus formed are lubricated, or moistened, by an oily kind of fluid, called the synovial fluid, secreted from the delicate synovial membrane which lines the interior surfaces of the joints.

To initiate, control, and direct all the movements of which this complicated machinery is capable is the grand function of the nervous tissue. The essential parts of the nervous system are certain centres, which generate nerve-force, and nerve cords, or nerves, which, like telegraph wires, communicate between these centres and every part of the body. The two main centres are the brain, encased in the skull, and the spinal cord proceeding from it, which is encased in the spine or spinal column; while both are frequently described together under the common title of the cerebro-spinal axis. The brain, besides being the seat of the intellectual faculties and the receptacle, so to speak, of all our sensations, is the centre from which all the voluntary movements of the body are regulated. The spinal cord, on the other hand, is the instrument through which the mandates of the will are conveyed to the muscles, and it also regulates many of the reflex, or unconscious, movements of the body. On examining a small section of a nerve-centre under the microscope, we find that it is composed of gray and white substances, the former consisting of minute cells, and the latter of very

fine tubules, or fibres. The function of the gray substance is to generate nervous force, while the tubules act as conductors of that force; but how this force is generated, or how mind and matter are linked together, we know not. This much, however, we do know, that on the brain depends our power to reason and will, our power to act, our power to acquire knowledge and store it up as in a granary, and that without it there is no conscious existence found among men. It becomes, therefore, a matter of the most vital importance that the nervous system generally should be kept in a high state of efficiency, and this can only be secured by the maintenance of sound bodily health, for a healthy body is above all things essential to a perfectly healthy and untrammelled mind.

Proceeding directly from the brain and upper part of the cerebro-spinal axis are the sensory nerves, such as those of sight, hearing, smell, and taste; while attached to the spinal cord by two sets of roots are the numerous spinal nerves, the one set communicating motor power to the muscles, and the other conveying sensation to the brain. The fibres in both sets of roots cross over to the opposite side of the cord at different parts, and hence it is that injury or disease of one side of the brain affects the opposite side of the body. These nerves ramify in all directions to the muscles to make them the ready instruments of the mind, and to every part of the surface of the body to receive impressions, and, by the sense of touch, to put us into direct relation with the external world.

But in addition to the cerebro-spinal system of nerves, there is another system, commonly called the sympathetic, or ganglionic, whose nervous filaments act independently of the will, and preside over the organic functions, such as the processes of digestion and respiration, and the movements of the heart. They have no direct connection with the brain or spinal cord, but arise from a number of dis-

tinct nervous masses, or ganglia, which are situated in the neck, chest, and abdomen, along the front and on either side of the spinal column. The action of these ganglionic nerves is entirely involuntary, and in this respect differs from that of the cerebro-spinal nerves. Through the agency of the latter we can at pleasure excite, direct, or arrest the motions of the ordinary muscles; but we have no such control over the muscles placed under the influence of the ganglionic nerves. The heart, for example, continues to beat with the same rhythm during sleep as when we are wide awake, the chest heaves with the same regularity in the act of breathing, and the various functions of the stomach and other internal organs continue unimpeded. But although the will has no direct power over the nerves of organic life, experience shows that the mind does exercise a certain amount of influence, and, as a matter of fact, there are numerous connections between the ganglionic and cerebro-spinal nerves. Hence it is that the emotions of joy or fear are followed by the quickened action of the heart, and that sickness, loathing, or faintness are often a consequence of deep mental disturbance.

To sum up this brief sketch, the functions controlled by the nerve-centres generally may be comprised under the different headings of:—(1) sensation, common and specific; (2) muscular motion; (3) the various processes associated with the nutrition of the body; and (4) all those mysterious phenomena of which the brain is the instrument, and known as the operations of the mind. As regards the connection which exists between mind and matter, science gives no answer. Only this much we know, that the human mind does act through the agency of matter, and that every thought which flashes through the brain is associated with a corresponding molecular change in the brain-tissue. But this intimate connection between

the material and immaterial parts of our nature affords no argument that thought is merely a secretion of the brain. We can only look upon it as a temporary arrangement or adjustment—as an ultimate fact, which we can neither account for nor understand.

IV. Digestion and Nutrition.

By the process of digestion the food is liquefied and reduced to a form in which it can be absorbed in the intestines, and afterwards taken up by the blood-vessels, and finally, by the process of nutrition, it passes from the blood-vessels to replace the waste material which is being constantly removed by the blood-current from every tissue and part of the body. In its passage through the alimentary canal—consisting of the mouth, gullet, stomach, and intestines, or bowels—the food is subjected to a series of mechanical and chemical actions, which reduce it to a homogeneous juice, or "chyme," and the more perfectly this process is attained, the more healthy is the digestion.

The first stage, then, in the process of digestion, is the conversion of the more solid articles of food into a pulp by mastication, or chewing, in which the jaws, teeth, tongue, and the salivary glands play a most important part. By the mechanical action of the jaws and teeth the food is broken up, and while this is going on the mass is being constantly moistened by the saliva, which not only lubricates it and renders it more easily swallowed, but also exerts a powerful chemical action in converting farinaceous ingredients into grape sugar. In flesh-eating animals, the teeth are so formed as to enable the animal to seize its prey and tear the flesh; whereas in herb-feeding animals, large and chisel-like front teeth are required to crop their food, and strong, rough back teeth are provided for grinding it. In man, we find an intermediate development

between the two, indicating that his teeth are evidently adapted for a mixed diet.

In order that mastication may be complete, it is highly important that the teeth should be kept in good order, and when they decay it is very desirable that they should be replaced by false ones. Then, again, the process of chewing should be deliberate and thorough, in order to break up completely the fibres of animal food, and, what is perhaps of more importance, to allow free admixture of the saliva with the farinaceous ingredients, inasmuch as the starch contained in these ingredients cannot be absorbed until it has first been converted into sugar. This chemical action commences in the mouth, is carried on while the food passes down the gullet, is continued in the stomach, and is finally reinforced by the intestinal juice.

The salivary glands are arranged in three pairs, and they pour their secretion by ducts into the mouth. The saliva itself is slightly alkaline, and contains little more than five per cent. of solid matter, the rest being water.

When the food has been sufficiently masticated, it is thrust backwards by the action of the tongue into the upper part of the gullet; and at the same time the opening into the windpipe is closed, to prevent the entrance of any solids or liquids into that channel. The remainder of the act of swallowing is effected entirely by involuntary muscular action, and the churning process which the food subsequently undergoes in the stomach and intestines is also involuntary.

The stomach is a large bag-like cavity, stretching across the body, and chiefly under the lower part of the left ribs —its left extremity, where the gullet, or œsophagus, terminates, being much more capacious than the right, which is made continuous, by a contractile orifice, with the intestines. The lining or mucous membrane of the stomach is studded all over with the minute orifices of numberless

tubular glands, which secrete the gastric juice, and in such quantity that it is estimated to amount to between ten and fifteen pints in twenty-four hours. This fluid, like the saliva, consists of ninety-five per cent. of water, but, instead of being alkaline, is slightly acid, from the presence of hydrochloric acid, and it contains that most important solvent, *pepsin*, which acts especially on the nitrogenous constituents. While the food remains in the stomach, it is constantly moved to and fro, and as it is converted into *chyme* it passes gradually through the small orifice on the left extremity into the small intestine. But in the passage of the food thus far, a considerable amount of the farinaceous ingredients, which have been converted into sugar, together with water and saline substances, is absorbed by the lining membrane of the gullet, and further absorption takes place in the stomach. Owing to the acidity of the gastric juices, the solvent action of the saliva on the farinaceous ingredients is retarded, but so soon as the chyme passes into the intestines this action is supplemented by the juice which is secreted from the pancreas. The pancreatic juice acts not only on the starch granules in the food, by breaking them up and converting them into sugar, but it also converts the fatty constituents into a milky emulsion capable of being absorbed by the numerous glands which line the intestines. Many of these starch granules, especially when the food has been imperfectly cooked, cannot be acted on by the saliva until their albuminous envelope has been dissolved by the gastric juice, and they are then either rapidly converted into sugar by the saliva which has been swallowed, or, more slowly, by the pancreatic and other intestinal secretions.

But along with the pancreatic juice there is poured into the chyme, as it passes from the stomach into the intestines, the special secretion of the liver. This organ puri-

fies the blood of noxious ingredients, and the bile is utilized in the process of digestion by arresting decomposition in animal substances, and further preparing the liquefied food for absorption. During its passage through the intestinal canal, which in an average adult is about twenty-five feet long, the process of digestion is completed, and the nutrient material is absorbed by numberless minute vessels, called lacteals. These are convoluted in small prominences, or villi, which stud the lining membrane of the intestines, and they finally converge to a common duct, named the thoracic duct, which discharges into the left jugular vein, while the undigested, indigestible, or effete matter is thrown off by the bowels.

Briefly, then, a meal as it passes downwards is first mixed with the salivary fluid, which converts into sugar, or renders fit for absorption, a large portion of its starchy, or farinaceous, constituents. It is next irrigated by the gastric juice, which dissolves its nitrogenous, or albuminous, constituents. It is then mixed with the pancreatic juice, which emulsifies the fatty constituents, and also acts on the farinaceous substances which have escaped the action of the saliva. At the same time, the bile is poured into it, and renders it more easy of absorption; and finally the intestinal juice, oozing out throughout a long canal, supplements the deficiencies of any of the previous solvent acts. The average total quantity of these various juices secreted in the twenty-four hours has been estimated to amount to nearly three gallons, and about ninety-six per cent. of them consists of water. This large amount of water is exuded by the intestinal canal, and is again absorbed, so that the stream is constantly going its round like an endless chain, taking up from the structures of the body what ought to be got rid of and removed, and taking in from the food what the nutrition of the body requires.

Apart from the water, sugar, and saline substances, which are absorbed in the gullet, stomach, and intestines directly into the minute blood-vessels, the other nutrient ingredients, after being dissolved and digested, are more slowly taken up by the meshwork of lacteals which line the intestinal canal, and finally, as we have seen, discharge into the left jugular vein. The fluid conveyed by the lacteals is called *chyle*, and is very like milk in appearance, and indeed very much resembles it in chemical composition. Before it is discharged into the blood-current, it is still further elaborated by passing through a series of minute glands, called lymphatic glands, and in the thoracic duct it mingles with another fluid, which is nearly colorless and of a saltish flavor, called lymph. This fluid is collected by a set of vessels which pervade the whole frame, named the lymphatics, and is derived from the various tissues in which these vessels originate, as a constituent part of the waste material which is selected as still available for nutrition. Both lacteals and lymphatics are freely provided with valves throughout their course, to prevent their contents flowing backwards when subjected to pressure. It is thus seen that not only is provision made by which the food digested in the alimentary canal finds its way into the circulation, but also that the fluid which is no longer needed for the nutrition of various tissues is collected and again returned to the blood, showing clearly that there is no unnecessary waste in the animal economy.

But after the nutritious chyle has entered the blood-stream, some further changes are required before it can build up tissues and fulfil other important purposes of the organism. This further elaboration, which need not be entered upon here, is carried out in the liver, spleen, and other glands; and finally, the various ingredients of the food are conveyed by the blood-vessels, not only to every

tissue, but to the minutest parts of every tissue in the body.

The right performance of the process of nutrition depends, in the first place, then, upon a due supply of pure and well-elaborated blood, upon the normal condition of the part to be nourished, and above all upon the formative capacity of the several parts of the various tissues, by virtue of which the newly formed structures are reproduced in the place of and exactly like those which have become disintegrated and removed. No matter how diverse be the character and composition of the various tissues, the blood supplies the material which each requires, and every tissue has an inherent power of abstracting from the blood whatever ingredients are necessary to repair waste and maintain it in a condition of healthy efficiency.

V. Composition of the Blood.

The blood is a red, viscid fluid, slightly alkaline, and consisting of water and of solid and gaseous matters. The water amounts to about seventy-nine per cent., and the dry solids to twenty-one per cent., while the gaseous matter contained in the blood is nearly equal to half its whole volume, or, in other words, 100 cubic inches of blood will contain rather less than fifty cubic inches of gases. The gases consist of carbonic acid, oxygen, and nitrogen, in the proportion of nearly two-thirds carbonic acid, one-third oxygen, and barely one-tenth nitrogen. Compared with the weight of the body, the total volume of blood amounts on the average to about one-thirteenth; so that a person weighing twelve to fourteen stones* would have from fifteen to eighteen pints of blood.

When fresh-drawn blood is examined under the microscope, it is seen to consist of a colorless liquid called

* From 168 to 196 pounds.

plasma, and of numerous globules, or cells, some of a reddish tint and others colorless, which float in it. The red corpuscles, or cells, are round flattened discs, slightly concave in the centre, and their size varies from $\frac{1}{3000}$ to $\frac{1}{4000}$ of an inch in diameter. They contain the coloring matter, and have a marked affinity for oxygen. The colorless corpuscles are somewhat larger, but not nearly so numerous, as the red corpuscles; and though the relation which they bear to each other has not been clearly determined, it is believed that the red corpuscle is simply the nucleus of the colorless corpuscle somewhat enlarged. It is also highly probable* that the colorless corpuscles are in reality constituent cells derived from the various tissues of the body which have been detached and carried into the blood. The plasma, or liquid in which these corpuscles float, is called the *serum*, and contains fibrin in solution. When fresh-drawn blood is allowed to stand in a vessel, it thickens or coagulates, the fibrin enclosing the red corpuscles gradually sinking to the bottom, while the serum floats on the top. Of the twenty-one parts of dry solids, about twelve parts consist of corpuscles, six parts of albumen, and three parts of a mixture of fibrin, saline, fatty, and saccharine matters, and sundry products of body-waste. In short, the blood not only contains all the materials necessary for the growth and repair of the various tissues, but also the products of their decay.

VI. The Circulation of the Blood.

We now pass on to consider very briefly the circulation, or the mechanism by which this liquid nutriment is conveyed to all parts of the body, going and returning in a never-ceasing stream. First, then, there is the powerful muscular heart, which, like a force-pump, drives the

* Much more evidence is needed, however, to establish this theory.—(R.)

blood by successive strokes through a series of elastic tubes, called the arteries. This organ is divided into a right and left side, or a right and left heart, each of which has two cavities, one of them called an auricle, and the other a ventricle. The muscular fibres which make up the walls of these cavities are so arranged that when the muscles of the heart contract, the cavities become compressed, and the blood which they contain is forced out of them. The walls of the auricles are thinner and less powerful than those of the ventricles, and the right ventricle is weaker and smaller than the left. In man and the higher animals, the heart is lodged between the lungs, a little to the left side, and nearer the front than the back walls of the chest, and its pulsations may be distinctly heard by placing the ear on that side.

Commencing, then, with the right side of the heart, the circulation of the blood is briefly as follows:—The right auricle receives into it the blood which flows along the great veins from the upper and lower parts of the body, and so soon as it becomes filled, it immediately contracts, and forces the blood through a valvular opening into the right ventricle. In its turn, the right ventricle becomes filled, the valves separating the two cavities are closed, the ventricle contracts, and the blood is propelled into the pulmonary artery through another opening provided with valves to prevent any backward flow. The pulmonary artery divides into two main arteries, which convey the blood into the lungs to be exposed to the action of the air, when it becomes changed from a dark to a bright red color. After being purified in the lungs, the blood is collected by the numerous capillaries, and conveyed by the small veins into four large pulmonary veins, and from them it flows directly into the left auricle. The left auricle then contracts and forces the blood through another valvular opening into the strong muscular left

ventricle, which contracts in its turn, and, the valves closing behind, the blood is pumped through another opening into the large blood-vessel called the *aorta*. This opening is also furnished with valves to prevent regurgitation of the blood; and the stream is thus propelled, by successive contractions of the left ventricle, along the aorta, which runs first upwards, then curves round and runs straight down in front of the spine, giving off in its course numerous branches, or arteries, which convey the blood to all parts of the body. Some of these large arteries branch off to the neck, head, and arms; others to the stomach, liver, bowels, kidneys, and other organs in the abdomen; while a third set branch off to the legs. The arteries, whether large or small, are composed of elastic fibrous tissue, which yields to each successive impulse of the heart. This impulse is conveyed along the arteries, and can be seen in some parts, as in the neck, and distinctly felt in other parts, as in the wrist. The pulse, which can thus be seen and felt, is the result of the contractions of the heart, and therefore equals them in number. It varies in frequency according to age, health, and other circumstances, but in a healthy man the average number of beats amounts to about seventy per minute. It is quicker in childhood and becomes slower in old age, and is slightly more frequent in women than in men. The large arterial blood-vessels which branch off to the neck, head, extremities, and all other parts of the body, subdivide into smaller ramifications, and these again into vessels of less and less diameter, until at last they terminate in a meshwork of channels so minute that they can only be detected under the microscope. The capacity of these capillaries, as they are called, is only large enough to allow the blood-corpuscles to pass in single file, as it were, and they are so crowded together in every tissue that a needle's point cannot be pushed into any part of

the body without wounding some of this meshwork of minute vessels. But though the arteries may be said to terminate in the capillaries, these vessels have no dead ends, so to speak—they open into another set of vessels, namely, the veins, which are the return-pipes connected with the living machinery. The smaller veins collect into larger and yet larger branches, and these again finally end in two main trunks, called the *venæ cavæ*, which, as we have seen open into the right auricle of the heart. The veins resemble the arteries in structure, but they are less elastic, and their walls are thinner and feebler. They differ, too, from the arteries in being provided with valves, which are intended to prevent any reflux of blood away from the heart, while they offer no obstruction to its onward flow to the heart. These valves are more numerous in the veins of the limbs and other muscular parts, and it can thus be readily understood that any muscular exercise assists the onward flow of the blood in the veins in the right direction, and that in this way it is a healthy stimulus to the circulation.

Such, briefly, is the circulation of the blood; but something more has to be added. Among the many large arteries given off by the aorta in the abdomen, there are two which deserve special notice. One of these supplies the stomach, intestines, and other organs, and, like other branches of the aorta, divides into small arteries, and these into capillaries, which again are gathered up into veins converging at last into a large vein, called the *portal* vein. Now, this vein, unlike other veins, does not join the current in the *vena cava*, which flows into the right side of the heart, but goes to the liver, where it branches into smaller veins, and these into capillaries, which form a meshwork in the substance of the liver. These capillaries collect into small veins, which are ultimately gathered up, and form a large vein, called the

hepatic vein, which opens straight into the *vena cava.* The other branch of the aorta, called the hepatic artery, also goes to the liver, and after dividing into capillaries, the blood which they convey mingles with that collected by the hepatic vein. A portion of the blood, therefore, is constantly passing through a double set of capillaries, exclusive of those in the lungs, to be elaborated in the liver for the secretion of bile and other substances which largely contribute to the process of digestion.

A word must now be said about the rhythmical action of the heart. Both auricles are filled, and contract simultaneously, and then immediately follows the filling and contraction of the ventricles, the right pumping the blood into the lungs, and the left into the arteries of the system generally. But while the ventricles are emptying themselves, the auricles are again filling, and this alternate dilatation and contraction of both sets of cavities goes on with a measured regularity, which is evidenced by the beating of the heart and the pulse, and by the sounds caused by the alternate closing of the different valves, which become audible when we place the ear over the left front of the chest.

Briefly, then, the circulation of the blood pursues this course:—right auricle, right ventricle, pulmonary artery, capillaries of the lungs, pulmonary veins, left auricle, left ventricle, aorta, arteries, capillaries (sometimes two sets), veins, venæ cavæ, right auricle again. It has been ascertained by experiment that in the horse this circulation is completed in about half a minute; but by far the greater portion of this half-minute is taken up by the passage of the blood through the capillaries. Owing to their exceedingly minute calibre there is greater friction, and the subdivided stream moves much more slowly than in the arteries; while their walls are so thin that they readily permit those interchanges between the blood and the tis-

sues which are necessary for the nourishment of the body and the removal of its effete materials. The passage of the blood-corpuscles through the capillaries may readily be seen by placing the web of a frog's foot, or the tail of a tadpole, under the object-glass of any good microscope. Those, again, who are desirous of making themselves more thoroughly acquainted with the structure of the heart, its situation and relation to the lungs, the nature and mechanism of its valves and cavities, and the relative position of the large vessels connected with it, cannot do better than obtain a sheep's *pluck* from a butcher's shop, and commence to investigate for themselves. They will learn far more by practical examinations of this kind than from any number of illustrations.

VII. Respiration, Oxidation, and Excretion.

The lungs, or organs of respiration, with the heart between them, are situated in the thorax, or chest, and are separated from the stomach, intestines, and other organs of the abdomen by the broad flat muscle extending right across the body, called the diaphragm, or midriff. This muscle is convex towards the thorax, so that when it contracts it increases the vertical dimensions of the cavity of the chest, while the transverse dimensions are simultaneously increased by the action of the muscles which move the ribs. For the function of breathing, therefore, we possess a bellows-like arrangement, which alternately contracts and expands under the control of the nervous system, bearing a close analogy, in its mode of action, to the circulatory apparatus. Each consists essentially of a kind of pump, which propels a fluid (in the one case aeriform, and the other liquid) through a series of ramified tubes, the difference being that in the lungs the inflow and outflow pipes are the same.

The two lungs occupy almost the entire cavity of the thorax which is not taken up with the heart, and each is enclosed in a kind of double bag, called the *pleura*, which enables the chest-movements to take place without friction.

When the chest expands by the depression or contraction of the diaphragm and the elevation of the ribs in consequence of the action of the intercostal muscles, the lungs, by virtue of their elasticity and the pressure of the external air, expand at the same time, so that no vacuum is left between them and the walls of the chest or the diaphragm. If, however, an opening is made, either by disease or accident, penetrating between the pleura, the external air at once rushes in, and the lung on that side collapses.

Although we can breathe either through the mouth or nostrils, the latter are the natural air-passages, inasmuch as they are always open. The opening into the windpipe itself is situated in the back part of the throat; and its mouth, called the *glottis*, is protected by a kind of lid, called the *epiglottis*, which immediately closes, under the impulse of reflex nervous action, whenever any article of food or drink is about to be swallowed. The glottis opens into the box-like *larynx*, containing the vocal cords, and this is made continuous with the *trachea*, or windpipe proper. The walls of the trachea are strengthened by a series of cartilaginous hoops, which are incomplete behind, where the tube comes in contact with the gullet, so that the tube is always kept widely open. After passing into the cavity of the chest, the trachea divides into two branches, which are termed the *bronchi*. Each bronchus enters the lung on its own side, and divides into a large number of small branches, named bronchial tubes. As these diminish in size, the cartilaginous rings gradually disappear, and the walls of the smallest tubes become entirely membranous, so that they may be almost closed by the con-

traction of their muscular walls. These tubes terminate in elongated dilatations, about $\frac{1}{40}$ of an inch in diameter, which are made up of a series of minute sacs, which open into them; so that the dilatations, when viewed under the microscope, bear some resemblance to bunches of grapes. The little sacs are the air-cells, and they are so thickly clustered together throughout the lung-tissue, that they are only separated from each other by very thin delicate walls, which contain the capillaries, into which the pulmonary artery conveys the blood from the right side of the heart. The blood, therefore, as it streams through these numberless minute capillaries, is exposed on both sides to the air; being separated from the air-cell on either side only by the exceedingly delicate pellicle which forms the wall of the capillary and the lining of the air-sac.

What is called the respiratory act consists of two parts, namely, inspiration and expiration, the air being first breathed in, or inspired, and then breathed out, or expired. In an adult man, breathing calmly in a sitting posture, this act takes place on the average from thirteen to fifteen times a minute, and at each inspiration about thirty-two cubic inches of air are inhaled into the lungs. But even after the most violent expiratory effort, there is a considerable quantity of what is called *residual air* left in the lungs, which amounts on the average to 75 or 100 cubic inches, while in ordinary breathing, the quantity left after expiration amounts to about double this; so that, on the average, the total quantity of air contained in the lungs after inspiration amounts to about 230 cubic inches.

Now, in order that the function of respiration may be carried on properly, it need hardly be said that it is of the first importance that the air which is taken into the lungs should be pure. Pure air consists almost entirely of a mixture of the two gases, oxygen and nitrogen, there being about four times as much nitrogen as oxygen. In

addition to these, there is a very small percentage of carbonic acid gas, a varying amount of watery vapor, and traces of ammonia, and ozone. To the reader who is interested in figures, the following table will supply the averages of these ingredients in 100 parts of pure air:—

Oxygen	20.99
Nitrogen	78.97
Carbonic acid	.04
Watery vapor, Ammonia, Ozone	traces

From numerous analyses which have been made in various parts of the world, it is found that the relative quantities of the oxygen and nitrogen remain the same, or nearly so. The nitrogen, so far as health is concerned, is useful only to dilute and mix the oxygen, and is remarkable chiefly for its negative properties. It is the oxygen alone which is essential to life, and on that account it has often been spoken of as "vital air."

Let us now note the changes which the inspired air undergoes in the lungs before it is expired. First, then, we find that, however dry the external air may be, the expired air is saturated with watery vapor, or nearly so; second, no matter what is the temperature of the external air, the temperature of the expired air is the same as that of the blood, or about 98° Fahr.; and, third, we find that the oxygen of the inspired air has been reduced from 21 per cent. to about 15 or 16 per cent., and that the carbonic acid has increased from .04 per cent. to about 4.7 per cent.; or, in other words, that air which has once been breathed has gained 5 per cent. of carbonic acid, and lost about 5 per cent. of oxygen. The amount of carbon eliminated during the twenty-four hours is represented on the average by a piece of pure charcoal weighing about eight ounces, while the amount of water given off during the

same period, under ordinary circumstances, is about nine ounces, or nearly half a pint. In addition to these substances, the expired air contains a considerable amount of animal matter, which speedily decomposes, and, when allowed to accumulate in a crowded room, becomes very offensive and injurious. The amount of nitrogen, with very slight variations, remains unaltered.

Such being the differences between the expired and inspired air, we can now understand the changes which the blood undergoes as it courses through the meshwork of capillaries in the lung-tissue. The dark, or venous, blood pumped from the right side of the heart gets rid of a large amount of carbonic acid gas, watery vapor, and effete animal matter, and as it is whirled along to the pulmonary veins, it absorbs about as much oxygen as replaces the carbonic acid. The oxygen, it is believed, is taken up mainly by the red corpuscles, and the blood, as it leaves the lungs, becomes of a bright red tint. This arterial blood, as we have seen, is pumped by the left side of the heart into every part of the body, carrying along with it the oxygen, which unites with the carbon, hydrogen, and nitrogen of the waste material of the tissues to form carbonic acid, water, and ammonia; and these products are taken up by the capillaries, and conveyed by the veins to be ultimately got rid of by the three excretory organs—the lungs, the skin, and the kidneys. The blood, therefore, while it is continuously distributing nutritious material to the tissues, is continuously removing waste matters from them, and these effete matters are seized upon by the oxygen and *burned*. It is this chemical action which is constantly going on within us which produces animal heat, and maintains the body at a temperature of from 98° to 100° Fahr. For just as the combustion of any substance, such as coal, or a candle, or gas, is simply the combination of the oxygen in the air with the substance which is being

burned, thereby evolving heat and yielding new products; so, in the oxidation of tissue-waste, heat is continuously evolved, and new and simpler combinations are formed. Hence it is that food is often spoken of as the fuel of the body, and the body itself likened to a steam-engine. The products of combustion of the coal which is used for the steam-engine are mainly carbonic acid and watery vapor; an immense amount of heat is evolved, which converts the water in the boiler into steam, and this again is converted into mechanical force, or power. So, in a somewhat similar, though much more complicated way, muscular force and all the movements of the body, as well as bodily heat, are the direct results of the oxidation of the materials which are primarily derived from the food.

We have already seen that a considerable portion of these waste products are got rid of by the lungs, and the skin and kidneys get rid of the rest. The functions of these three secretory organs are closely allied, and though they differ much in appearance, they are constructed on the same principle. In ultimate anatomical analysis, each is found to consist of a very thin delicate membrane, the one surface of which is free, or communicates with the exterior of the body, while the other is in contact with the blood. The blood, as it passes through the numberless capillary channels in these organs, is thus purified, by a process of filtration, in which the excreted matters are, as it were, strained through this thin delicate tissue, and removed from the body. The duty of the lungs, as we have seen, is to eliminate carbonic acid, watery vapor, and a small portion of effete animal matter; the function of the skin is to get rid of a large quantity of water, a small amount of carbonic acid, and a certain quantity of saline matter; while the kidneys get rid of ammonia (as urea and uric acid), a large amount of water, and a considerable amount of saline substances. The average quantity of

water given off by the skin during the twenty-four hours is about twice as much as that given off by the lungs, or nearly a pint; while the carbonic acid eliminated does not exceed $\frac{1}{40}$ of that excreted by the lungs. Although under ordinary circumstances no liquid is perceptible on the surface of the skin, there is, nevertheless, a certain amount of what is called *insensible perspiration* always going on; on the other hand, during violent exercise and intense heat combined, the cutaneous perspiration may become so excessive that a man may lose two or three pounds in an hour. Besides water and a small amount of carbonic acid, the skin also secretes, through the sebaceous glands, certain fatty matters, and it is constantly throwing off scales from the external layer of the epidermis. The kidneys secrete nearly two and a half times as much water as the skin; but very much depends on exercise, clothing, and the temperature of the external air.

We thus see, therefore, that water is the principal excretion of all three organs, while most solid matter is given off by the kidneys, and most gaseous matter by the lungs. In its functions, the skin is more allied to the kidneys than to the lungs, so that when the free action of the skin is interrupted it is usually thrown upon the kidneys; and when the skin acts freely there is less stress thrown on the kidneys, as during warm weather or violent exercise.

The indigestible portions of the food and those which are not assimilated, as has already been pointed out, are got rid of by the bowels.

But these various vital processes, or functions, could not be carried on or regulated unless they were kept in strict harmony with each other. If, for example, the balance of healthy life is to be maintained, the food supplied must be at least equivalent to the tissue-waste, and be of a kind to be properly distributed to supply that

waste. Or, again, if the body's temperature is to be maintained at a tolerably constant rate, no matter what be the temperature of the external air, both respiratory and circulatory systems must be carefully regulated and kept under control. Hence the necessity of a controlling or regulating organ, and this is supplied by the nervous system. This it is which enables us "to live, and move, and have our being;" to know what is going on around us; to stimulate us, by the promptings of hunger and thirst, when to take our food, and to feel when we have had enough; it enables us to discriminate between what is suitable and what is unsuitable; it controls the alimentary apparatus, the respiratory apparatus, the circulatory apparatus, and the excretory apparatus, for the most part in entire independence of the will; and so long as these functions are in operation, the body is said to have life. When they cease to act, life becomes extinct, and the physical forces which, during life, were the slaves of the bodily organism, now become its masters. The oxygen, which was the scavenger of the living frame, now becomes its destroyer, and atom by atom reduces the complex tissues to simpler compounds, such as carbonic acid, water, ammonia, and soluble salts. Even the bones and teeth are finally dissolved and decomposed. All these simpler compounds, as we have seen, may again furnish nutriment to the plant, the plant to the animal, and the plant or animal, or both, may once more become part and parcel of the living frame of some being yet unborn.

No better illustration of this ceaseless cycle of matter can be given than in tracing the course and transmutation of the carbonic acid gas given off by our lungs. Though we exhale it as a waste product every time we breathe, though it is thrown out in enormous volumes by gas-jets, fires, and furnaces, it never accumulates in the free air of heaven around us; for the economy of nature tolerates no

waste—no accumulation of effete matters. This gas, which is so fatal to animal life, is ordained to be indispensable to vegetable life. We exhale it, and plants inhale it, so that every tree which is still left room to grow in a crowded city, and every plant on a window-sill, transmutes it by the heat of the sun into blossom and leaf and stem, imprisoning the carbon and setting the oxygen free. The coal which we now burn was made up, ages long ago, of plants fed by the nourishing heat of the sun from the carbonic acid in the air, and both the heat and the carbonic acid are returned to us as we sit by the blazing fire. And so, too, although we cannot rebreathe this gas without injury, we can use it as food in our vegetables, and transmute the heat pent up within it in the leaves and roots into the warmth of our bodies, the strength and activity of our limbs, and even the very thoughts which flash from our brains.

CHAPTER III.

CAUSES OF DISEASE.

An old writer has quaintly asked, "Who is he that values health at the rate it is worth? Not he that hath it; he reckons it among the common ordinary enjoyments, and takes as little notice of it, or less regards it, than his long-worn clothes; perhaps more careful of his garments, remembering their price; but thinks his health costs him nothing, and coming to him at so easy a rate, values it accordingly, and hath little regard to keep it; is never truly sensible of what he enjoyed until he finds the want of it by sickness; then health, above all things, is earnestly desired and wished for."

Although it is the poor man's stock-in-trade, how often is it thoughtlessly and recklessly squandered? How often, too, is it sacrificed in the race to be rich? And yet the rich man would gladly part with all his wealth to regain it. For health is one of the mainsprings of human happiness, because it not only implies freedom from bodily pain or discomfort, but without it there can be no real enjoyment of life or of the varied pleasures which surround us. It more than compensates for any inequality in social position, and may even make a king envious of a beggar. And yet, though all this has been accepted as trite and true ever since moralists began to sermonize on mankind and their follies, there is too much reason to fear that the scattered seed still falls on somewhat stony ground. Ill health and disease often set in so insidiously, that warnings, which in themselves are significant and distinct enough,

are allowed to pass by unheeded, until at last even the man who was originally blessed with a strong constitution begins to find that he can no longer take liberties with himself, and is fortunate if he can still retain a fair stock of health by becoming more careful as to what he eats and drinks, or more exemplary in his personal habits and mode of living generally. Very frequently it happens that he finds out his mistake when it is too late; and he may thus be doomed to wander through life a hopelessly incurable invalid, or perhaps to sink into an early grave. "The excesses of our youth," says Colton, "are drafts upon our old age, payable with interest about thirty years after date;" but too often the drafts have to be met at dates much earlier than this.

If health, then, is rightly regarded as the greatest of mortal blessings, it surely becomes a matter of paramount concern to be in a position to know how disease, which has been designated the greatest of mortal evils, may be averted. Now, so long as disease was believed to be a separate entity, a something inflicted on the living body as a "visitation," its causes were looked upon as inscrutable, and consequently no intelligent efforts were made to remove or mitigate them. It was not till physicians began to discover that the phenomena of disease were in reality but derangements of the organization of the body or of one or more of its functions, that any actual progress became possible in the direction of prevention or control. For in order to be able to control disease, it is essential that the physician should not only comprehend its nature, but should be able to discriminate its various phenomena, and such accurate discrimination is only of recent growth. Then, too, it has to be pointed out, that underlying the whole art of prevention, is this other great truth, established in these latter days by the researches of the physiologist—that the animal organism is intended by nature

to pass through a prescribed period of existence from natural birth to natural death, and that it is incapable in itself of originating any of the manifestations of disease. We have, therefore, to look outside the body for influences or agents which operate as causes of disease in all its multiform phases, and with an ever-widening knowledge we find that though many of these causes are uncontrollable, many more are controllable, and to an extent which we have reason to believe renders them preventable.

Foremost among the uncontrollable causes of disease, are those atmospheric changes depending upon seasonal variations, ranging from the extreme cold of winter to the summer scorching heat. Even on the healthy body, and apart from any manifestations of disease, these seasonal changes produce influences of a well-marked kind. For example, it was proved by Mr. Milner, late surgeon of the Wakefield prison, from a large series of observations made during several years, that during the winter months the body loses weight, while it gains during the summer months; and the changes from loss to gain, and from gain to loss, take place respectively about the beginning of April and September.

It is true that these changes may be considerably modified by regulating the diet and varying the clothing; but they nevertheless show that the seasons and the variable climate of this country exert a far more powerful influence on the bodily functions than is usually supposed.

For example, a sudden fall of temperature is sure to be followed by a long train of ailments, such as catarrh (or common colds), influenza, bronchitis, and other forms of lung disease; and when we turn to the tables of the Registrar-General, we find that the mortality bears a very intimate relation to age. Thus, according to Dr. Farr, if the degree of mortality following upon a lowering of the temperature below freezing point be expressed as 1 in

1000 at the age of twenty, it becomes 2 at the age of twenty-nine, 4 at the age of thirty-eight, 8 at the age of forty-seven, and so on, doubling with every nine years of life. Then, again, if we consider the relationship of diseases to meteorological conditions, we find that certain diseases, such as bronchitis and pneumonia, or inflammation of the lungs, have their greatest fatality in the first quarter of the year, that it gradually falls during the second and third quarters, and again increases during the fourth quarter. The fatality consequent upon other diseases, such as influenza, pleurisy, and quinsey, is in a great measure similarly influenced; and there are many other ailments which, though they originate independently of weather changes, have nevertheless their intensity greatly modified by them. During the first and fourth quarters of the year, the low average temperature is accompanied by low barometric pressure and increased moisture in the air, and as these are conditions unfavorable to the equalization of the temperature of the body, they readily give rise to febrile disturbance, which is a marked symptom of the diseases under consideration.

If we come now to inquire into the effects of excessive heat, we find that, apart from cases of sunstroke, which are not numerous in this country, they chiefly act upon the digestive organs. Just as extreme cold is a fruitful cause of disease of the organs of respiration, so excessive heat becomes a source of danger to the organs of digestion, and hence it is that the deaths from diarrhœa and bronchitis, which may be taken as typical diseases of the two conditions, bear a constant relation to the higher and lower temperatures of summer and winter. No doubt, a considerable amount of the diarrhœa which is prevalent during warm weather is due to the fermentive changes induced in articles of diet, and to the foul effluvia given off by decomposing filth of all kinds; but at the same

time, there can be no question that excess of heat is followed by a relaxed state of the system, and a great diminution in the vital changes going on within the body which operate especially on the organs of digestion.

But though meteorological conditions are thus shown to be prominent uncontrollable causes of disease, their direct effects are nevertheless capable of being greatly modified by due attention to clothing and house-warmth, and by an intelligent regulation of diet and exercise according to age, sex, occupation, and bodily constitution. The primary care is to endeavor to maintain the body at all hours and seasons at an equable temperature, and this especially applies to the aged and the very young. All these are points, however, which will be more fully noticed further on.

We now proceed to the consideration of causes of disease which are more or less controllable, and in briefly discussing so wide a subject it will be convenient to do so under the following heads:—

I. Hereditary Influence.

II. Self-Induced and Social Causes of Disease.

III. Material, Local, and Communicable Causes of Disease.

Section I. Hereditary Influence.

To those who have paid any attention to the domestication of animals, there is no fact more familiar than the wonderful resemblances, extending even to color and markings, which can be produced over and over again in a well-selected stock. While we see in every direction the wide and various transmission of incidental varieties in each species, depending originally to a large extent on combinations of natural causes, we cannot help being struck with the precision with which these varieties can be perpetuated by judicious management; and not only

so, but man has actually the power, by careful selection, to produce animals after a few generations presenting peculiarities of conformation, color, or size so distinct and well defined that they virtually constitute a new variety. Look, for example, at the numerous breeds of horses, dogs, and cattle, or the different varieties exhibited in a well-filled poultry show-yard. In all of them we cannot fail to recognize the all-powerful influence of hereditary transmission; and yet there are few among the general public who reflect that the same laws of heredity operate with as much force on the human race for good or for evil, as they do in raising or deteriorating any particular variety of inferior species. In this sense, civilization is to man what domestication is to the lower animals. In man, as in animals, heredity stamps the physique and moulds the form and features; and just as instinct is purely the heritage of the animal, so mental and moral proclivities become the birthright or birthwrong of the newly-born child.

While the prominent inheritance of the child from its parents is its physical type, its external conformation, its stature, physiognomy, and the color of its hair and skin, it is no less true that temperament, idiosyncrasies, and mental endowments are as transmissible as external resemblances. Not that parents repeat themselves exactly in their offspring, but they certainly impart to the constitution, in a very large degree, the special direction which life has already taken in them. Hence it may be said that every family has its organic patrimony—a statement which is popularly illustrated by the expressions "good blood" and "bad blood." Some families, as we all know, are given to stoutness, while others are very spare; some are tall and stalwart, while others are small and wiry; some are very dark-complexioned, while others are very fair. In like manner, hereditary influence affects the

structure of the internal organs, and modifies every phase of vital action. Hence it is that some families are long-lived and healthy, while others are notably short-lived; some are dyspeptic and bilious, while others seldom or ever suffer in this way. So, too, as regards mental qualities and temperament, we find that some are gifted with marked mental endowments, while others are dull, stupid, and lethargic; some are arrogant and overbearing, while others are gentle and unassuming. But without multiplying instances of the influence of heredity on mental capacity and proclivities, I may refer the reader to Mr. Galton's work on "Hereditary Genius," or, as regards a scientific exposition of the whole subject, to Mr. Darwin's writings on the domestication of plants and animals.

To put it very briefly, the main doctrine which lies at the foundation of hereditary influence appears to be this—that the accumulation of individual variations or characteristics, through recent descent, has a far greater influence upon a man's bodily and mental constitution than the unchanged gifts of a remote ancestry; so much so, indeed, that these latter may be regarded as a vanishing quantity. In other words, the progeny is invariably moulded by the characteristics of its more recent ancestry, and by those of the parents, more than by those of its grand-parents, and so on backwards, in a constantly decreasing ratio.

Not to refer again to the influence of parentage, the influence of the other immediate progenitors on the bodily constitution of the offspring is manifested by the resemblances which crop up under that singular law of heredity known as Atavism, where a bodily peculiarity existing in a family is partially or wholly lost in one generation, reappearing in that which follows, or even yet later. The influence of race, on the other hand, is manifested by the constancy of averages, under tolerably constant conditions,

from generation to generation, and this not only as regards the whole body and its various component parts, but also as regards all the facts which are comprised within the range of social and vital statistics. Another law, which has a wide bearing on the physical condition of communities, is this, that deviations from these averages or from the normal type, although they are transmissible, cannot go beyond certain limits. Thus, as regards size, the giant and dwarf form the extreme limits of the chain; and hence, in the procreation of individuals representing these deviations, the tendency to revert to the normal type is invariably manifested in the offspring. In the same way, as all forms of deterioration or disease may be regarded as deviations or perverted life-processes, they are likewise subject to limitation in transmission, and there is the same tendency exhibited to revert to the normal type under improved conditions. Thus, though many diseases, such as consumption, scrofula, gout, and insanity, are hereditary, the special disease may be finally eradicated from the family by adopting suitable measures, and the morbid tendency be eventually overcome.

Having said so much generally with regard to the laws of heredity, let us now consider their hygienic application. And first of all, it has to be noted that acquired characteristics may become a family heirloom. For example, the man who, though originally strong and healthy, gives way to vicious habits, runs the risk of branding his offspring with a diseased or enfeebled constitution. If he becomes a drunkard, the chances are that some of his children will become drunkards too. If he lives too well and becomes gouty, the gouty tendency which he has contracted will, in all likelihood, be inherited by one or other of his children or their descendants. If, through occupation, or being housed in an unhealthy dwelling, he becomes consumptive, his children have to face the dangers of

scrofula or lung disease, and should they live under the same conditions, this danger becomes greatly increased. Or again, if, from worry and overwork, he shatters his nervous constitution, he may have an imbecile for his heir, or a wild-cap to scatter to the winds his hard-earned wealth. Last of all, should he become a reprobate criminal or thief, what a terrible legacy other than a felon's name may be bequeathed to his offspring! All these are instances of the deep significance of the old Bible text, "The sins of the fathers shall be visited upon the children, even unto the third and fourth generations."

It is one great characteristic of hereditary taint that it takes advantage of its opportunity; in other words, the different stages of growth or decay through which the body passes favor more or less the manifestation of this or that kind of hereditary tendency. Hence it is that some few diseases appear to be hereditary from birth, others after a long period, while others remain unaroused for an indefinite period because they are not influenced by any exciting causes from without. This is but too painfully illustrated by the hereditary tendency bequeathed by consumptive parents. In childhood, for example, this tendency very frequently manifests itself in the disease known as tubercular meningitis, or inflammation of the lining membranes of the brain; in youth, the glands of the neck become attacked; while in early adult life, what is called phthisis, or true consumption, breaks out in the lungs. Insanity, again, which is to a large extent a hereditary malady, if it does not declare itself in the idiocy of the child, seldom attacks the offspring until the whirl of the passions begin to have full play in early manhood. Hereditary gout rarely becomes developed before the age of thirty, and the liability to cancer, which is far more common among the female than it is among the male sex, is seldom manifested before the age of forty. It further

appears that, if the age is passed at which any particular taint is liable to become aroused into activity, the morbid hereditary tendency is materially lessened. At thirty-six years, the individual born of consumptive parents may reasonably look forward to reaching a mature age.

Another deeply interesting question here crops up for consideration in connection with the aptitude to repeat the morbid state which the parents presented, and it is this—what are the causes which bring this liability into play? Indeed, it is only by virtue of a due appreciation of these causes that hygiene becomes powerful to combat this hereditary tendency to disease, and to stifle it in its first beginnings. It is because hereditary disease does not usually burst forth without the influence of exciting causes that we can dispute with it incessantly the organ or particular part of the body which it threatens. And speaking generally, it will be found that we can best subdue any particular hereditary tendency by studying the causes which produced it in the first instance, and as far as possible guarding the offspring, especially at critical ages; against the operation of these causes. For example, the child of a consumptive parent should be well fed, carefully clothed, have plenty of exercise in the open air, should not be allowed to sleep in an over-crowded room or live in a damp house, and should not be put to any occupation which cramps the free play of the lungs, or endangers them by the inhalation of foul air. On the other hand, the son of a gouty father or grandfather should be particularly careful not to live too generously, to avoid stimulants, and to take plenty of active exercise. Or again, if the taint of insanity lurks in the family, every effort should be made to curb the passions, to control the temper, and to eschew whatever may lead either directly or indirectly to violent mental disturbance.

If, now, we come to consider the course of hereditary

transmission, we find that it is not always an easy matter to determine it in many instances; for the morbid tendency often travels in a capricious way across posterity. It can leap over a generation, and reappear in one or other of the grandchildren, or attach itself to one of the two sexes. There is, however, one law connected with it, which asserts itself with terrible severity, and it is this—that any particular taint, if common to both parents, is liable to be greatly intensified in the offspring. It is on this account that marriages between cousins or near blood relations are inadvisable, inasmuch as latent morbid tendencies, should they form part of the organic patrimony of the family, are almost certain to become developed in the children. If cousins come of a strong and healthy parentage on both sides, there is no physiological objection to their marriage—indeed, the chances are that the family physique and mental characteristics will be improved; but if there should happen to be a lurking taint common to both, it will seldom fail to impair the vitality of the offspring. The Nemesis of this law is so tellingly chronicled in the history of many a family, that the thoughtful reader will have little difficulty in discovering instances, either among his own relations or in the wider circle of his friends and acquaintances; or, if he wishes to search further afield, he will find that it is in consequence of this law that ancient aristocracies, reduced to repeated inter-marriage, have become first degenerated physically, and have become finally extinct, sometimes by drifting into imbecility, or dementia, or, at all events, by becoming infertile.*

* The practical value of that great medicine of the future, Preventive Medicine, will, I think, be much enhanced by general recognition of an *active* elimmative law in Nature which I have formulated as THE EXTINCTION OF THE UNFIT. This ordinance is the direct antithesis of Darwin's survival of the fittest, and one chief business of Sanitary science is to counteract its influence by rendering individuals, families, or nations, doomed in accordance with its conditions, to speedy death from inherited disease, more fitted to survive.—(R.)

And now, before adverting very briefly to the practical bearings of this all-important subject, it is necessary that some notice should be taken of other consequences of unsuitable or imprudent marriages. Without discussing over-population theories, it is evident that when a man marries, no matter what his age may be, at a time when he can barely earn his own subsistence, and when he has no other resources to look forward to, he runs the risk of begetting a family which he cannot rear without the aid of pauper relief. The consequence is that this unthriftiness in marriage, prevailing as it does among the ignorant and degenerate, leads too often to intentional neglect of the children, amounting to culpable homicide.

Then, again, such of the children as do survive the terrible evils attending upon squalor, ignorance, and neglect, only serve to swell the dwarfed and sickly looking crowd which nestle in the rookeries of our large towns. Side by side, too, with this unthriftiness of marriage, there is another cause of deterioration of the offspring, namely, the practice which prevails, more especially among the artisan and laboring classes, of marrying too young; and the reason is that too early marriages, like marriages which take place too late in life, if not infertile, result in the birth of children afflicted with a lowered vitality. And not only so, but how often do we see the very young mother become a permanent invalid, barely able, if able at all, to nurse her children, and through the ill health, induced by a too early marriage, imparting to her offspring a vitiated heritage! Indeed, so numerous are cases of this description, that some physicians, who have carefully studied the subject, maintain that no woman should marry before she is twenty-one years of age, and further, that her own health, and consequently that of her children, has a much less chance of becoming deteriorated if marriage on the average is de-

layed to the age of twenty-five. As regards the other sex, it may be said generally that no man has a right to marry unless he is in a position to provide a comfortable home for his wife, and that he should endeavor to delay the period of marriage until he is at least twenty-five years of age.

Reverting, however, to hereditary tendencies, it may be readily inferred, from what has previously been said, that apart from the question of consanguinity, no weak, scrofulous, or consumptive men should marry any but strong, healthy women, if they marry at all; and this, of course, applies equally to the opposite sex. Indeed, if the consumptive tendency is strong and well-marked, there can be no question that the individual so afflicted should avoid marriage altogether, or, at all events, should never dream of entering the married state until the critical age has been safely passed, and even then not without taking medical advice. Then, too, it need hardly be said that it is most undesirable that two persons should marry in whose brains lurk the seeds of insanity. Such a union would be tempting a terrible curse upon any children that might be born, and throw an awful responsibility upon the parents.

In entering the married state, health is wealth in the real sense of the word—better far than a well-lined purse, which is the prize too often run after, even when so-called prudential motives come into play, to the utter disregard of all other considerations. Not that money need be any objection—on the contrary, it is often a great aid to comfort and happiness; but money becomes, after all, a poor solace for the unavailing regret which follows the ill-assorted match, when the parents can only hope that others will be warned by their example. The thoughtful and sensible may become warned thereby; but the thoughtless, ignorant, and reckless, it is to be feared, will continue to reproduce a diseased, vitiated progeny, with

a blind indifference to all laws, until the time comes when knowledge, with its blessings, will reach even them, and thus become the means of preventing many a tragedy and saving many a life.

In taking leave of this subject, I cannot do better than quote the eloquent words of Dr. Farr:—"The hygienic problem is how to free the English people from hereditary disease: hereditary consumption, cancer, syphilis, gout; hereditary insanity, hereditary vagrancy, hereditary criminality; and to develop in the mass the athletic, intellectual, æsthetic, moral, and religious qualities which have already distinguished some of the breed. There is a divine image in the future, to which the nation must aspire. The first step towards it is to improve the health of the present generation; and improvement, if as persistently pursued as it is in the cultivation of inferior species, will be felt by their children and their children's children. A slight development for the better in each generation implies progress in a geometrical progression; which yields results in an indefinite time, that, if suddenly manifested, would appear miraculous."

Section II. Self-Induced and Social Causes of Disease.

The sources of disease included in this somewhat indefinable group, although numerous and intricate, are largely under individual control, and the manifestations of disease to which they give rise are, therefore, in the strict sense of the word, preventable. They depend mainly on a personal disregard of the laws of health, often through ignorance, sometimes through indifference, and sometimes through reckless neglect. Not a few of them are associated with the exactions and usages of society, and some are incidental to the pursuit of certain occupations, which are injurious to health and life; but,

however classified, the mere enumeration of the more prominent among them will suffice to convince the reader how wide and varied is the list, and what a fruitful source they are of disease and death. Intemperance, errors in diet, abuse of the luxuries of life, overwork, idleness, want of self-control, irregular modes of life, errors in clothing, unhealthy occupations, are all of them causes which merit consideration under the above category.

1. *Intemperance.*—I prefer to use the word intemperance rather than alcohol as a cause of deterioration and disease, because I am frankly of opinion that the moderate use of alcoholic stimulants has not been proved to be detrimental to the health of persons who may be said to partake of them daily, but who are careful never to exceed. To many people, and especially to the slightly dyspeptic, they frequently prove valuable aids to digestion; to the thoroughly temperate, they make the wheels of life run more smoothly, without in any way injuring its machinery; while to the aged, they often prove a boon, by imparting warmth as a respiratory food, and by inducing refreshing sleep, which would otherwise forsake the pillow. If, again, we look at the broader aspects of the question, we find that civilization itself exhibits a strange unison with the consumption of alcohol. Compare, for example, the average physique and mental culture of beer-drinking Germany and whisky-drinking Scotland, with those of moderate Spain and abstemious Turkey, and making every allowance for racial differences and differences of climate, we can, at all events, discover no reliable grounds for the doctrine so persistently advocated by many, that alcohol is in itself a poison, or that its use need necessarily prove the curse of this or any other country. By all means let those abstain who believe they can get on very well or better without it; let those also abstain who have not sufficient control to prevent

them from indulging occasionally, repeatedly, or habitually to excess; but surely this intolerant raid in favor of total abstinence, and total abstinence alone, is based on arguments which are radically weak, and defeats its own ends by arousing opposition which it would be wiser to conciliate. The advocates of temperance are quite as much alive to the terrible evils of alcoholic excess as are the most strenuous advocates of total abstinence; and, indeed, it may be fairly said that the cause generally has prospered far more vigorously since the former have taken to the public platform, than during all the years when the latter strove to gain the public ear. Not that I wish to disparage in the least the vast amount of good which the advocacy of total abstinence principles has been the means of producing, but because no unbiased mind can help regretting that self-control, which, after all, is exercised by the many, should be supplanted by a sacred promise, or oath, which, it is to be feared, is as often violated as it is observed. So long as free-will has play, it is not a pledge, but conviction, that will gain the day.

At the same time, I am free to admit that the great majority of healthy men and women can get on very well without alcohol, and that the amount which can be partaken of habitually, without risk of endangering the health, is for most people comparatively small. It is well known that it can suddenly be left off by the immoderate drinker without any immediate detriment to health, and doubtless with ultimate advantage. Then, as regards physical endurance, it has been proved over and over again, in fatiguing campaigns and long, weary marches, that the soldier who abstains can face danger with as stout a heart, and march with as firm a step, as the soldier who takes the spirit ration. All this goes to prove that alcohol is not absolutely necessary to health,

and, indeed, when an appeal is made to the statistics of Life Assurance Societies, the argument appears to be very much against even what is called moderate drinking; for, according to a paper which was read by Mr. Vivian, the Chairman of the United Kingdom Temperance and General Provident Institution, before the British Association, in 1875, the difference in the mortality of the abstainers and moderate drinkers is very remarkable. It was found, for example, in nine years (1865–74), that, while 1110 deaths were expected among the abstaining insurers of the institution, according to the calculations of the actuaries, only 801 deaths occurred; whereas, during the same period, the number expected to die among the non-abstaining or moderate drinkers, who had insured, amounted to 2002, and the number of deaths which actually occurred was 1977. According to this statement, and others of a similar nature, whose validity cannot be impugned, the prospect of longevity is largely in favor of total abstainers, and the only weak point in the argument is this, that the majority of the non-abstainers insured in the same society were probably not moderate drinkers in the strict sense of the word, but persons who, on the average, took considerably more than the amount of stimulants consistent with the maintenance of sound health.*

But in order that the reader may be able to realize the dangers which attend the too free use of stimulants, let us now consider very shortly the physiological action of alcohol, whether it be imbibed in spirits, wine, beer, or

* This defense of moderate drinking, "in the strict sense of the word," is, I am happy to say, better suited to the social atmosphere of England, than to that of the more enlightened portions of America. An observant traveller soon learns to think that the English rear so many drunkards, *because* they are a nation of moderate drinkers. I consider that no man who has formed the habit of drinking, is competent to decide for himself when, or how much, spirits is good for him; and my advice to every one is never to taste alcohol except on the written prescription of a reputable physician.—(R.)

cider. The first symptom which deserves notice is the quickened action of the heart, as shown by the increased rapidity of the pulse; and along with this there is dilation of all the small blood-vessels, or capillaries. The vessels of the skin become turgid, as shown by the flushed face and the warm glow all over the body; the vessels of the stomach become likewise full of blood, and hence the feeling of "comfort within;" the minute vessels of the brain are also overcharged—the brain becomes more active, thoughts flow more rapidly, and speech becomes more free, and sometimes more eloquent. This may be called the stage of exhilaration—a stage which is often reached at the convivial dinner-party, but which as often carries with it the penalty of what is called "seediness" next day; a fact which shows but too clearly that even at this stage there is danger, if not actual detriment. Whenever the face becomes slightly flushed or the tongue begins to wag too freely, the convivial guest or the genial host may be quite sure that he has had enough, and more than enough; the danger-signal has been hoisted.

If the alcoholic dose, so to speak, is still further increased, the higher, or controlling, part of the brain becomes paralyzed for the time being; reason is off duty, and the lower, or animal, impulses begin to manifest themselves. Then, too, the motor nerve-centres become implicated, as shown by the inarticulate speech and unsteady gait. In the last stage of all, there is utter unconsciousness and helplessness to move; the heart and lungs may still act, but the victim is veritably on the brink of death, and it only requires an extra dose to kill him outright. Along with these changes, there are others to be noted, which seriously affect the temperature of the body. During the stage of exhilaration, the temperature exhibits a distinct increase, owing mainly to the dilated condition of the capillaries under the skin; but in consequence of

this dilation of the blood-vessels, and the more rapid flow of blood through them, there is increased radiation of animal heat. In other words, the body is parting more quickly than usual with its warmth; very soon the normal temperature is regained, and during the third or last stage of intoxication it is found that the temperature has fallen very much below the average. It is on this account that alcohol, even in moderate doses, cannot be tolerated in very cold climates; indeed, the loss of heat which ensues is found to be so great, that its use is practically abandoned in all Arctic expeditions. On the other hand, there can be no question that its use is a fruitful source of disease in hot climates. Much of the dysentery and allied disorders of the alimentary canal, and notably diseases of the liver, are due to stimulants, probably because the oxidation of alcohol is very much retarded in warm weather, and because the excessive action on the skin has a depressing influence on the nervous system.

Adverting now to the habitual and excessive use of alcoholic liquors amounting to intemperance, it may be said at the outset that the general effects are of a cumulative nature. The strong and active individual blessed with a sound constitution may be able to withstand the inroads of actual disease for many years, but long before he has passed his manhood's prime he begins to find that he is not such a good man as he used to be. After a time, he discovers that certain kinds of stimulants disagree with him—he is obliged to give up his beer, he is afraid of port, and he begins to look askance at champagne. After a long series of headachy and depressed mornings, which even "pick-me-ups" fail to make enjoyable, he ruefully resolves to be a little more careful, and he forthwith begins experimenting how not to rob himself of his allotted quantity of alcohol, and yet avoid the painful consequences which it is but too clear he has brought upon

himself. He has been mixing his liquors too much—some of them have been too fruity, and he will try dry sherry, and, to make amends for his late-born care with regard to wine-drinking at the table, he allows himself an extra glass of whiskey-and-water or brandy-and-soda before going to bed. But he soon finds, much to his disappointment, that all this is of no avail, and if he is a wise man, he will either knock off stimulants altogether for a time, or restrict himself to an amount which is within the limits of strict temperance, although far below that which he has been accustomed to take for years.

Fortunately for the public health in general, and for personal health in particular, the great majority of so-called moderate drinkers take warning in time, though often, it may be, through painful experience; but it is no less true that there are thousands in this country who, in spite of these warnings, drift heedlessly and recklessly onward to certain disease and premature death. Of the minor ailments which assail the intemperate at the outset of their career, I may mention some of the more common—headache, neuralgia, dyspepsia, gouty and rheumatic symptoms, colds, languid circulation, palpitation, mental depression, inertia, disturbed rest, twitching of the muscles, and passing derangements of the bowels and kidneys. In fact, the vital powers generally become seriously deteriorated before many years are over, and the transit from functional disturbance to acute or chronic disease may be either sharp and sudden or slow and insidious, but in either case it is inevitable if habits of intemperance are continued.

The following are some of the more serious effects which remain to be considered:—

The nerve-centres become degenerated, and epilepsy may result as a terrible sequence to the involuntary muscular twitchings which were unheeded as danger-signals, or paralysis, either general or local, may supervene. But

of far more common occurrence are other morbid states, which are more or less mental in their character, for after a time over-indulgence steadily weakens the self-control of the hapless victim, and ultimately makes him an utter slave to his lower and mere animal nature. The craving for drink becomes well-nigh irresistible—honor, self-respect, the tears of affection, the dictates of conscience, are alike powerless to effect reform; the victim of intemperance has at last become a veritable dipsomaniac, whose only chance of cure is restraint in an asylum or some other place of retreat.

Closely allied to this pitiable condition, there is another which is exemplified by intermittent indulgence to maddening excess. This form of disease is called the *mania a potu;* the victim is not habitually intemperate, but at intervals he gives way to indulgence to such an extent as to become a terror to his friends on account of his violence and brutality. Such cases as these are the despair of magistrates; they crowd our gaols for barbarous and unprovoked assaults, especially on helpless wives; but punishment and admonition appear to be of little avail in preventing frequent relapses.

The disease known as *delirium tremens* is another terrible instance of the effect which alcoholic excess may exercise over the nerve centres. The disease is characterized by muscular tremors, a low temperature, with cold and clammy skin, persistent wakefulness, then delirium, with all the horrors of the most hideous phantasmagoria which the imagination can possibly conceive. During the attack the patient is literally hovering on the brink of the grave, and although recovery under proper care and treatment is common, it need hardly be said that the system has received a shock from which it will take long to recover.

The extreme instances of disorganization of the nervous system are found in our lunatic asylums—beings who have

lost every attribute of humanity except the name; hopeless, helpless, doomed to a living death until they cease to live.

Among diseases induced by alcoholic excess which attack other parts of the body, may be mentioned heart disease, and more particularly that form of it which consists in a degeneration of the muscular substance itself; disease of the larger blood-vessels, represented by aneurism; and disease of the small vessels or capillaries, thereby interfering to a serious extent with the nutrition and healthy action of almost every one of the vital organs. Thus, while the repeated dilatation of the lung-capillaries renders the person addicted to habits of intemperance liable to attacks of bronchitis, pleurisy, or pneumonia, the structural degeneration of these vessels, which is apt to supervene, leads not unfrequently to a form of consumption, consisting in a rapid breaking down of the lung-substance, which every kind of treatment is powerless to arrest.

In the same way, there is first enlargement of the liver from the frequent engorgement of the capillaries, and this is followed by a shrinking, or shrivelling up, of the substance of the organ, together with rough and uneven surface, when it gets the significant name of *hobnail*, or *drunkard's liver*. Diseases of the liver are very common among hard drinkers, and are especially liable to be induced in warm climates. In extreme cases, dropsy is a usually concurrent symptom, and when that sets in death is not far off.

Another organ which becomes affected in various ways, and often to a fatal extent, by alcoholic excess, is the kidney. Every one knows how readily the secretion of this organ is altered by even a single debauch; yet it is not generally realized that the pinkish-looking sediment or the iridescent film which floats on the surface of the fluid, are both of them conditions which are favorable to

the formation of stone or the development of gravel. Then the strictional deterioration of the capillaries, induced by continued excess, leads to that form of disease of the kidney known as "Bright's Disease," or the repeated dilation of these vessels may be followed by an attack of acute inflammation of the organ which, if it does not terminate fatally, is almost sure to leave serious complications behind. Indeed, so powerful is the influence of alcoholic excess on the vital action and structure of the kidneys, that physicians who are most competent to form an opinion maintain that at least three-fourths of the instances of kidney disease which come under their notice are due to this cause, and to this cause alone.

These, then, are some of the more pronounced effects of intemperance; but, unfortunately, statistics do not help us to form any reliable estimate of the vast amount of disease and suffering which is actually entailed. When it is borne in mind, however, that the intemperate man is far less able to resist the influence of weather changes than the man who is temperate, that his relaxed vessels are liable to give way under light pressure, and that there is actual deterioration of the body generally, it will be at once conceded how much more liable he is to succumb to other causes of disease, and how much less his chances are of weathering the storm when disease actually sets in.

In a paper read by Dr. Norman Kerr, at the Social Science Congress last year, he pointed out that, though the deaths attributed to alcoholism in England and Wales during 1876, according to the Report of the Registrar-General, were only 1120, an analysis of the deaths which occurred in his own practice warranted him in saying that the actual mortality during the twelve months throughout the country could not be estimated at less than 128,000. Dr. Richardson's estimate is 40,000, while the late Mr. Wakley, coroner for Middlesex, and his

successor, the late Dr. Lankester, both agreed that one-tenth of the entire mortality among us resulted from alcoholic excess.

As regards the part which intemperance plays as a cause of crime, there can be no dispute. Indeed, so fully has this become recognized among judges and magistrates, that it has been long accepted as a truism that were it not for the drink our gaols would be well-nigh tenantless.

And now a few words in conclusion. So far as scientific investigation can lead us, we are not warranted in saying that the moderate use of alcohol is injurious. So far as experience can guide us, we are warranted in saying that the limits of strict moderation are so easy of transition, that many people who never become intoxicated suffer repeatedly, and in the long run permanently, from the effects of over-indulgence. Some persons are so constituted, whether through habit or natural tendencies, that they are prone to indulge to excess, it may be occasionally or continually, when opportunity occurs. The only safeguard for such is total abstinence. Whenever a man deliberately imbibes stimulants to help him through a difficult task or to drown sorrow or remorse, he imposes a loan on his system which, if frequently repeated, will be sure to land him in physiological bankruptcy. What really is wanted to cope with the national evil of intemperance are not so much repressive or prohibitory measures as greater inducements and opportunities for the practice of temperance; and among these may be mentioned—better and more comfortable homes for the working-classes; better education in cooking for the wives; the establishment of coffee stalls, cheap restaurants, and coffee taverns; the establishment, as on the Continent, of well-conducted stalls for the supply of refreshing drinks during summer in the thoroughfares of our large towns; and, above all, the continuous and per-

sistent discussion of the drink question. This alone can lead to intelligent conviction, and without intelligent conviction there is but little hope of real national reform.

The safeguards in respect to personal health as regards the use of stimulants will be discussed in a future chapter.

2. *Tobacco and Narcotics.*—Although the great majority of the adult male population of this country are smokers, it cannot be said that the use of tobacco is a fruitful source of disease. No doubt, when the habit is carried to excess, it produces functional derangements of the nervous system, palpitation of the heart, certain forms of dyspepsia, and irritation of the throat and lungs; but the cases of well-pronounced disease which can be attributed to its influence are doubtful or rare. Much stress has been laid on the fact that the active principle of tobacco, namely, nicotine, is a deadly poison, which acts powerfully on the heart; but the small quantity which does get into the blood of the moderate smoker is rapidly eliminated by the kidneys, and does not appear to do any harm. Used in moderation and at proper times, tobacco produces a certain soothing influence without exercising any tangible injurious effect. On the other hand, too many pipes or cigars will cause nausea and depressing sickness, even in those most habituated to its use, while it is well known that a few whiffs will suffice to produce the same symptoms in those who try it for the first time. It is, therefore, not an agent to be trifled with, and without attributing all the dire effects to it which are laid to its charge in such a wholesale and indiscriminate way by its opponents, there are certain precautions with regard to its use which, I think, cannot be too strongly insisted on. In the first place, there can be no dispute that tobacco-smoking, when contracted as a habit, has a most deleterious action on boys and lads who have not stopped growing. It arrests their growth, and not only

so, but it produces an enervated state of the system, which tends greatly to impair muscular and mental activity. No one, therefore, should learn to smoke, or be allowed to smoke when it can be prevented, until he has reached the age of eighteen years, and even then I would honestly say, as a smoker, that it is a habit which, on the whole, had better be dispensed with, especially if one is ambitious and eager to succeed in life. Those who have not learned to smoke do not miss it, and if they do not experience its soothing effects they at all events escape many of the discomforts which are too likely to follow an extra pipe or cigar. Unless a person is almost continuously in the open air, the pipe or cigar had better be dispensed with during the day, or only indulged in after a meal. The moderate smoker, as a rule, reserves his pipe or cigar for the evening before retiring to rest. Any one who indulges to such an extent as to render the tongue coated and dry does himself an injury, and when palpitation of the heart or other nervous symptoms are induced, he should leave off altogether.

As regards opium, chloral, or other narcotics, it may be said, once and for all, that they should never be taken repeatedly or continuously, even in the smallest doses, unless under medical advice. Although they are valuable remedies in the treatment of disease, they are dangerous agents at all times, and those who habituate their bodies to their use run the inevitable risk of shortening their lives.

3. *Errors in Diet.*—It is a well-known fact that vast numbers among the affluent or well-to-do people in this country are in the habit of consuming a much larger quantity of food than is actually required for the maintenance of sound health. The consequence is that there is not only frequent derangement of the digestive organs, dyspepsia, and the like, but the system generally becomes

enfeebled and inactive, the body over-corpulent, the stomach over-distended, the muscles fatty and flabby, the heart weak, and the brain sluggish. These are among the common results of excess, and the sufferers may be said to constitute the great bulk of patients who crowd the consulting-room of the fashionable physician and frequent the numerous hydropathic establishments throughout the country.

Among men who are actively employed in business pursuits, on the other hand, there are many who drift into ill health because they often eat their meals hurriedly, or at irregular hours, or allow too long intervals to elapse between the times of taking food. Among the less affluent classes, again, dietetic errors are frequently committed because they are tempted to secure quantity rather than quality in their articles of diet, and the ill effects which result are often aggravated by bad cooking. Then, too, there are large numbers amongst the working classes who subsist almost exclusively on bread, potatoes, and other starchy foods, and they are easily recognizable by their pale looks, attenuated forms, and weak and flabby muscles. More especially is this species of chronic starvation common among the wives of the poorer classes, and women employed as sempstresses, and there can be little doubt it is to their insufficient diet that the craving for tea at all hours of the day is in great measure due. Much more nutriment would be obtained, and much mischief avoided, if cocoa were more freely used; for it is well known that over-indulgence in tea-drinking induces a long train of dyspeptic symptoms, accompanied by great excitability of the nervous system, which are as painful as they are unfortunately common.

But errors in diet, though productive of serious illness and disease amongst the adult population, are far more detrimental to infants and children. Indeed, there are

few people who have any adequate conception of the enormous waste of infant life which results from diseases induced by the insufficient, improper, and careless feeding of infants. In the previous chapter it has been shown that out of every 1000 children born, 150 die before they reach the age of one year, and I do not think it is making too high an estimate, if I say that one-third of these deaths are attributed to what may be called starvation-induced ailments. Assuming, further, that the number of children born annually in the United Kingdom amounts to 1,000,000—and that is pretty near the mark—there is thus an annual sacrifice of at least 50,000 infant lives. What are the errors to be avoided, and the rules to be adopted with regard to the feeding of infants and young children, and in respect to age generally, will be considered more fully in the Chapter on Food.

4. *Mental Worry and Overwork.*—In these days of fast living and "the making haste to be rich," the numbers who land themselves in what has been called physiological bankruptcy long before they have reached the age of sixty, are far greater than is generally supposed. The excessive competition commenced at school and college, though not without its risks, becomes a fruitful source of impaired health and premature death, when it is allowed to have its full swing in the struggles, ambitions, and cares of every-day life. And this is more especially witnessed among that large class of the community who constitute the prop and mainstay of the nation, our merchant princes and those engaged in commercial pursuits generally. Whenever a man begins to stick to business so closely that he finds no time for healthy recreation, no leisure for a holiday, and only hurried moments, from morning till the drudgery of the day is over, to attend to his bodily wants, he is putting an extra strain upon his system, which soon begins to tell with

increasing severity, and very frequently culminates in a complete breakdown. It matters not whether his motives are pure and unselfish, as in his desire to educate and rear a young and increasing family, or selfish in the extreme and begotten of the mere love of money-making for the sake of the social advantages which wealth too often confers; the results are the same. By-and-by he begins to find that his day's work has become a toil, and that the last pile of figures to be added up, or the last budget of letters to be answered, appears to be a much more harassing and difficult task than in days of yore. He is more liable to make mistakes, more apt to overlook important minutiæ, and prone to forget still more important engagements. He becomes miserable and dissatisfied with himself, exhausted and irritable when he goes home, his dinner is unrelished, the evening paper ceases to interest, nothing seems to please, and when he retires to rest his sleep is fitful, unrefreshing, and often broken by hideous dreams.

Now, all these are symptoms so characteristic of mental strain and worry that they may be regarded as danger-signals, indicating clearly that the speed must be slackened; indeed, the best restorative, when it can be taken, is a holiday, with change of scene and surroundings, to distract the attention, and plenty of outdoor exercise. But it often happens that the holiday cannot be taken, and the drudgery has to be gone through day after day, until a more convenient season arrives. It is in this stage that men frequently have recourse to stimulants to spur on their jaded energies, or to narcotics to procure sleep; and when it comes to this, the case assumes a very serious aspect, for when a man, harassed by overwork and mental strain, takes to stimulants, whether to drown care or spur him on, physiological bankruptcy, if not absolute ruin, stares him in the face. His reserve fund of physical

endurance is speedily dissipated beyond all hope of recovery, his mental powers become permanently impaired, he may drift into dementia, sink into paralysis, or become a doomed man through nervous failure in some vital organ, and dies from disease of the heart, the lungs, the liver, or the kidney.

With regard to physical strain and overwork, only a few words need be said, although the subject is a wide and interesting one. Its effects are most pronounced, and best seen in the stunted forms of the operatives in all our large towns, the great majority of whom had to toil in the factory so soon as their young hands could be made to assist their needy and thriftless parents. It is true that much of the injury hitherto inflicted on children in this respect is now prevented or greatly mitigated by the operations of the Half-Time and other Factory Acts, which prohibit the employment of children under a certain age, and limit the hours of labor of those who are older; but that this cause has contributed largely to the physical deterioration of the working classes in manufacturing and mining districts there can be no question, although, as will be seen subsequently, other causes have operated powerfully in the same direction.

The mischief arising from physical overstrain, either in youth or adult life, is, I believe, limited to comparatively few cases. No doubt there is damage done occasionally to the heart and some of the large blood-vessels, but, considering the large numbers who indulge in severe exercise and athletic contests, the risks to the strong and active are trivial compared with the advantages which are gained. Even as regards that most severe contest of all, the University boat-race, Dr. Morgan, of Manchester, has proved, by an appeal to statistics, involving an inquiry into the physical history of previous crack oarsmen, that the dangers of immediate or future mischief have been

grossly exaggerated. At the same time, I am free to confess that excess in this direction, as well as in others, is a waste of energy, and courts mishap.

5. *Idleness.*—In contrast to that large class of the community who suffer from overwork, there are numbers who suffer, though, perhaps, not to such a great extent, from sheer idleness. Among the poorer classes, they go to swell the list of vagrants who fill tramp wards, many of them get into prison because they prefer to steal rather than work, and mostly all of them end a short and fitful existence in the workhouse, the prison, or the lunatic asylum. Among the affluent classes, those addicted to idleness suffer not only from the miseries incidental to *ennui*, but they are liable to induce one or more of the many ailments incidental to over-indulgence, whether in eating or drinking, and to degeneration of the tissues from want of sufficient bodily exercise. In addition to these, there are many who, after a life of toil, retire to enjoy their well-earned savings. The business or profession which has occupied their energies during the prime of manhood is abruptly thrown aside; they have unfortunately cultivated no pursuit or pastime which can relieve the monotony of their self-enforced leisure, and the consequence is that they speedily feel out of sorts, frequently become hypochondriacal, and are constantly liable to succumb under slight attacks of acute disease. Men who are thus circumstanced, and who have cultivated no such healthy outdoor sports as shooting, fishing, or hunting, should be careful to take plenty of healthy exercise, and interest themselves in the management of local affairs, by aspiring to a seat on the bench, by becoming town councillors, or members of local boards, or by taking an active part in furthering any good cause which tends to the amelioration of humanity.

There is no doubt that amongst the well-to-do classes,

ladies suffer far more from the effects of idleness than do men. For in the first place, their physical training when at school has been, as a rule, sadly neglected; and in the second place, the aversion to activity of any kind—except, perhaps, it be dancing—which has thus been induced, becomes habitual to them, so that in after years they become more or less invalidish, and are seldom out of the doctor's hands.

In order to insure health and happiness as well, there must be no lolling in the lap of luxury or sitting listlessly with folded hands. Constant and healthy exercise of body and mind are alike necessary, otherwise there is certain deterioration and untimely decay.

6. *Immorality.*—This cause of disease is productive of immediate disaster, and of far-reaching ill effects on posterity, which are only known to the physician and physiologist. It was the cause of the downfall of ancient Greece, and the warnings and denunciations directed against it in the Sacred Writings are sufficient to convince the reader how powerfully it affects the healthy life of the individual and the well-being of society. Self-control is the only safeguard against the terrible dangers which beset the paths of sexual vice, and those who scout the sin are most sure to court the danger. Unfortunately, however, neither parents, teachers, nor guardians, seem to appreciate the important change in the individual which occurs at the age of puberty, or, if they do appreciate it, they fail, through a sense of false modesty, to warn or guide, and it is because this responsibility is so generally neglected, that so many, when reaching maturity, unknowingly or unwittingly drift into evil courses.

7. *Irregular Modes of Life.*—There can be no doubt that impaired health is very often induced by late hours and irregular curtailments of the natural night's rest. The earnest student, the man about town, the leading

ladies in society, and their troops of followers, all err grievously in this respect, either occasionally or habitually. Look at the fashionable ball, for example; dancing seldom or never commences before ten o'clock, more frequently much later, and is carried on till three or four in the morning. The consequence is that every one feels jaded and worn out, even after a few hours' rest, and many experience the ill effects for several days afterwards. No wonder that at the close of the London season there are so many wan cheeks and pale faces, hungering for the pure air and quietude of life in the country. Dancing in itself is one of the healthiest of exercises, but practised as it is in crowded ball-rooms, and during such unnatural hours, the benefits which would otherwise accrue are more than neutralized by the ill effects which follow sooner or later. Those who have the seeds of consumption lurking in their constitution, are especially liable to suffer, inasmuch as they run the terrible risk of arousing the disease into activity.

Students, literary men, press men, and reporters are among the most common sufferers from the depression and lowered vitality begotten of late hours and broken rest. No doubt the strong man can often resist sleep for long periods, but sooner or later the time comes when nature asserts her violated rights—the demand for sleep becomes more urgent, and fortunate is he who can woo back the friend he has deserted. The penalty which is too often exacted is that distressing sleeplessness, or insomnia, which allows the mind no rest, or at best a rest which is broken and disturbed by fitful dreams. When the sufferer is reduced to this painful condition, he frequently has recourse to opiates or other sedatives, which only afford temporary or doubtful relief, and if persisted in will infallibly produce serious and permanent mischief. A holiday, with change of scene and air, and

regular hours, will often do wonders in restoring the jaded brain to a healthy condition; but whether a holiday can be obtained or not, a steady effort must be made to retire to rest at regular hours, and not too late.

As regards the amount of sleep which a healthy adult requires during the twenty-four hours, it may be laid down as a rule that on the average it should not be less than six hours, and need not exceed eight. There are some men, such as the late Count Cavour, and General Eliott so well known for his famous defence of Gibraltar, who only rested four hours; but these are exceptional cases. Children and old people require more than eight hours; indeed, infants and the very aged pass a large portion of their time in sleep.

Concerning the hour at which the individual should retire to rest, a good deal will depend on the hour at which he is expected to get up. No doubt early rising is highly conducive to health; but "early to bed and early to rise" is one of those golden rules which many people find it very difficult to follow. In the country, if one gets up at six o'clock, the hour of retiring to rest should be about ten for grown-up people, nine for young people, and seven or eight for children. If one does not require to get up before seven in summer and eight in winter, eleven should be the hour for going to bed; and it is only under exceptional circumstances that it should be later than twelve. Another good rule is, never to lie in bed when once quite wide awake in the morning. It is much more invigorating to turn out at once, for second naps indulged in towards the usual hour of getting up are generally followed by dull heavy days.

Then, too, it has to be said that regularity as regards the hours at which meals are taken is of the utmost importance in the maintenance of health. As has previously been pointed out, many of the worst forms of dyspepsia

are induced by inattention to this matter, and when once induced, they are often difficult of cure. Every one, therefore, ought to strive from youth upwards to cultivate habits of regularity and punctuality, to retire to rest at proper hours, and to partake of food at regular intervals; for in all the laws of life, habits, whether for good or evil, become in a measure "second nature."

8. *Errors in Clothing.*—As this subject will be more fitly discussed in a subsequent chapter, it will suffice to indicate here very briefly some of the more important discomforts and ailments which are induced in this way. Thus, as regards the feet, tight or badly fitting boots or shoes are well known to be productive of much mischief; garters, again, are apt to give rise to varicose veins; tight stays, to ailments of a grave kind connected with the functions of respiration and digestion; thick veils, to headaches; too light clothing, to colds and congestion of the lungs; and so on. Then, too, there is the connection between clothing and body cleanliness, which opens up other important questions regarding personal health; but this, too, will be reserved for consideration further on.

Section III. Material, Local, and Communicable Causes of Disease.

Almost all these causes of disease are more or less under Legislative control, and belong more especially to the domain of public hygiene. But inasmuch as public measures, however well-devised for the preservation of the health of the community, can never be efficiently carried out unless they meet with the intelligent co-operation of the people themselves, it is very essential that these widespread causes of disease should become generally known and duly appreciated. Briefly summarized, they consist of impurities in air, whether in connection with

dwellings, unhealthy occupations or localities; bad water; unsound food; and infective particles or germs, which, passing from the sick to the healthy, induce diseases of a specific nature.

1. *Impurities in Air.*—We have already seen, in the previous chapter, that pure air consists of a mixture of the two gases oxygen and nitrogen, in the proportion of about 21 of the former to 79 of the latter, together with a very small percentage of carbonic acid gas, a varying amount of watery vapor, and traces of ammonia and ozone. It has also been shown that it is the oxygen alone which is essential to life, and that the expired air differs very much in composition from the pure air which has been inspired, inasmuch as about five per cent. of the oxygen has disappeared and been replaced by carbonic acid gas. The relative amount of nitrogen remains pretty much the same, because it only serves as a convenient medium for dilution. The watery vapor, however, is considerably increased, and along with it there is exhaled a certain amount of organic effluvia, or effete matter, which is even more injurious under ordinary circumstances than carbonic acid gas.

In its concentrated form, this foul matter is the source of that disagreeable, sickly smell so often met with in crowded rooms, and, along with the carbonic acid gas, is the cause of the drowsiness, headache, and feeling of faintness, which many people experience when they are huddled together in closely confined or badly ventilated places. Indeed, air which has once been breathed is no longer fit to be breathed again, for not only has it been robbed of a large portion of its oxygen, but products which are dangerous to life have been added to it in considerable quantities. Hence the necessity for ventilation, that is, by providing means for the escape of the foul or vitiated air, and for the entrance of fresh air to take its place.

As an extreme instance of the terribly fatal effects arising from overcrowding and want of fresh air, I need only refer to the oft-quoted story of the Black Hole of Calcutta—how, out of 146 prisoners who were shut up in this dungeon during the night, only twenty-three were brought out alive next morning, and most of these subsequently succumbed to putrid fever. Then there are records of numerous catastrophies befalling slaves or passengers in holds of ships when hatches were battened during a storm at sea. These are extreme instances, and attract attention because of their appalling severity. But of more concern to the public generally are the slow, unsuspected, and insidious effects arising from breathing air which has already been breathed, and thereby de-vitalized, or vitiated, by the products of respiration.

And prominent among diseases which are induced in this way must be placed that terrible disease consumption, or pulmonary phthisis, which in round numbers destroys 50,000 people every year in England and Wales, and accounts for nearly one-tenth of the total number of deaths. As has already been shown, there can be no doubt that the disease is in a large number of instances an inherited disease, but at the same time, there is a mass of evidence of the most indisputable kind which proves that it is a disease which has in thousands of instances been produced by breathing the impure air of small, overcrowded, or badly ventilated rooms, and is so produced still, in spite of the legal enactments against overcrowding.

But besides consumption, there are other diseases of the lungs, such as inflammation of the lung-substance, and bronchitis, which are also induced by impure air, and to a very large extent. Although there is no doubt that these diseases are in a great measure attributable to sudden changes of temperature, I cannot help thinking that in reality they are very often due to the attempts which are

made during severe weather, and in confined sleeping-places, to close every opening as far as possible in order to keep out the cold air. The consequence is that during the long nights of winter, the air in sleeping-rooms becomes much more impure than during the warmer months, and the results declare themselves in the greatly increased rate of mortality from lung diseases, and a far greater amount of sickness from chest ailments. Scrofula, too, which is so closely allied to consumption, is another disease which is largely dependent upon the same cause; but there is no need to prolong the list, when we consider that in innumerable instances the breathing of impure air night after night, and more particularly in the crowded homes of our large towns, entails a burden of ill health and discomfort, which, though it may not lead to actual disease, makes childhood joyless, and manhood and womanhood too a lifelong misery. And so, very often, is begotten that craving for drink which, when it becomes habitually gratified, makes the burden still harder to bear. Moralists are in the habit of pointing to the miserable overcrowded home as one of the consequences of drink, and no doubt it is; but for my own part, I am inclined to believe that the home, with its vitiated air, is just as often the cause.

Be that as it may, there can be no question that it is in these overcrowded and badly ventilated homes that disease finds its readiest victims. Typhus, for example, is a fever which thrives essentially in vitiated air, and it is one of the best signs of the improvement which is gradually taking place in the homes of the poorer classes, that it is a much rarer disease than it was not many years ago. Indeed, there are good grounds for hoping that, like the gaol fever of John Howard's days, and the Plague and Black Death of the Middle Ages, it will at no distant date be reckoned among the scourges of the past.

But in addition to the impurities given off by the lungs

and which accumulate in respired air, the air of the house is often rendered still more unhealthy by the filthy dust and effluvia which result from the sheer want of cleanliness, or from hidden dangers connected with drains, cesspools, and the like. Typhoid fever, diphtheria, ulcerated sore throat, croup, diarrhœa, erysipelas, pyæmia, and I have every reason to believe, scarlatina, have over and over again been originated by the foul effluvia which taint the air in and around our dwellings. In the better class houses, where scrupulous cleanliness with regard to every other particular is observed, it is found too often that, owing to some sanitary defect or neglect, sewer gas is finding an entrance into the house through some unventilated closet-pipe, some sink-pipe, or some over-flow pipe from a bath, and typhoid fever or some other filth disease, with death ever near, breaks out. Then, again, in town and country districts alike, there are the foul smells from midden heaps,* cesspits, pigsties, and the like, which, tainting the air outside the dwelling, pollute the air inside, rendering the enjoyment of sound health impossible at the best, and but too frequently inducing one or other of the diseases which have already been mentioned. It is true this is an unsavory subject, but no one who has not had opportunities of judging for himself can form any adequate conception of the widespread suffering and terrible mortality which result from this befoulment of the air we breathe, whether through ignorance, want of proper precautions, or sheer uncleanliness, in allowing filthy abominations and garbage of all kinds to accumulate around dwellings.

But great though these evils be, they are, as regards masses of the population, immensely aggravated by the vitiated air of small and badly ventilated shops, ware-

---

* Manure heaps or dunghills.

houses, factories, workshops, and mines. For in many of these industries the air is not only polluted by the products of respiration, but it becomes laden with minute particles consisting of organic matter or mineral substances, varying according to the particular trade or employment. As a matter of course, this finely divided dust is inhaled into the lungs, and with such terrible effect that in some classes of industry, the average duration of life is shortened by many years. Thus, the steel-grinders of Sheffield suffer from gradual destruction of the lung-tissue; coal-miners, from what is called "black lung;" the scourers in pottery works, from asthma; brass-founders, from bronchitis and ague; and so on through a long dreary list of trades, which, though they make the land hum with labor, have, after all, to be carried on under conditions more or less hostile to the enjoyment of sound health.

But, it may be asked, cannot these conditions be improved and ameliorated? There is no doubt they can; and what is more, they have been, and are being improved every day. Indeed, there is perhaps no more gratifying feature in the Reports of the Registrar-General than the statistics which prove that, under the operation of various Acts for the regulation of mines, workshops, and factories, the rate of mortality in many of these employments is steadily declining. By prohibiting the employment of workers under certain ages, limiting the hours of labor, securing better means of ventilation, and introducing various appliances to remove the irritating dust or fluff given off, the risks to health, which not long ago were enormous, are becoming less and less every year. Moreover, employers of labor are beginning to learn, and many of them have learned already, that apart altogether from philanthropic motives, any judicious expenditure which ensures better health for their work-

people is a wise investment, and saves money in the long run.

Then, too, it should be remembered that there are large numbers of work-people, such as tailors, dressmakers, shoemakers, and the like, whose workshop is their sleeping-room as well, with too often no bedstead but the floor, and only dirty rags to cover them and the poor squalid children who may be penned up with them. In large towns, ladies fond of wearing fine dresses, and for that matter, gentlemen too, would shudder if they only knew in what kind of dens their fashionable garments are often stitched together. And, what is more, the foul air of the reeking chamber may contain the germs of small-pox, scarlet fever, or some other infectious disease, from which any of the inmates may be suffering, and, clinging to the fine dress of the fashionable wearer, when it is sent home, may thus work further mischief. The only real safeguard against such dangers, and they are far from being mythical ones, would be to prohibit by law master-tailors, fashionable milliners, and similar employers of labor, from sending out work to be done at the homes of their work-people, unless such homes are ascertained to be in good sanitary condition, and kept under strict supervision.

Dampness of the air inside the house, from damp walls, damp foundations, or damp surroundings, is also a fruitful source of disease, giving rise to various forms of neuralgia, rheumatism, and consumption. As an instance in point, it may be mentioned that of late years consumption has become much less common in many towns where important sanitary improvements have been carried out, and careful inquiry has shown that the lowered mortality from this disease is due to the drying of the subsoil which has been effected by new drainage works.

In order to keep the air of the house pure and healthy, there must be no damp foundations, no damp walls, no

dark and dingy cupboards or corners to confine the air and devitalize it, no filth in or around the dwelling to pollute it, and no over-crowding. There should be cleanliness everywhere, adequate means of ventilation, plenty of window space to let sufficient light into every room, and proper appliances for warming during cold weather. All these, however, are points which will be more fully discussed in a future chapter. Meantime, it may be briefly pointed out that, notwithstanding the numberless impurities which are being incessantly poured into the atmosphere, they are as constantly being utilized or rendered innocuous. Injurious gases become diffused, diluted, or decomposed; suspended matters are washed down by the rains or fall by their own weight; animal emanations are absorbed in the processes of vegetation; while many organic substances are oxidized and thus rendered harmless.

2. *Impure Water.*—Almost all waters used for drinking purposes, unless it be the rain-water collected from roofs, contain a certain amount of mineral matter dissolved from the soil or particular formation of rock which receives the rainfall and from which the water supply is obtained. Hence it is that well-waters are found to vary in hardness according to the nature of the subsoil, or geological formation, some containing so much mineral matter as to render them unfit for use, except perhaps for medicinal purposes, as is the case with so-called mineral springs. Water derived from streams or rivers is, as a rule, much softer than well-water, though that also varies very much according to the character of the water-shed. The mineral matter consists for the most part of compounds of lime, soda, and magnesia, and unless these are present in quantities to render a water very hard, it cannot be condemned as unwholesome. Indeed the ailments which have been traced to the presence of these sub-

stances in drinking-water are comparatively few, and by no means prevalent. Constipation and other dyspeptic symptoms have been attributed to excess of earthy salts, but the disease which more than any other appears to be intimately connected with these ingredients is goître, and chiefly in districts where the magnesian limestone formation prevails. Among other mineral substances found in drinking-water, the compounds of lead are the most injurious, and these are usually absorbed from leaden pipes or cisterns, the danger of lead being dissolved being much greater if the water is soft.

When water contains an excess of vegetable matter, it is decidedly unwholesome, and has often been known to produce diarrhœa and aguish symptoms, but the ingredients which are especially dangerous are of animal origin. The least trace of filth from a cesspool, drain, or manure-heap may convert drinking-water into an insidious poison fraught with disease and death. Very frequently the water may be clear and sparkling, and not unpleasant to the taste, so that its polluted condition is not suspected until serious illness has broken out in the household, and illness of a kind which points to filth as the originating cause. A sample is then submitted for chemical analysis, when it is pronounced to be highly polluted, and altogether unfit for use. The investigations into the later outbreaks of cholera in this country proved clearly that the disease was, if not wholly, at least to a very large extent, propagated in this way; but the disease of all others which owes its origin and spread to polluted water is typhoid fever. In country districts, and in small towns or villages, where pump-wells or shallow dip-wells constitute the source of supply, this disease is produced far more frequently by polluted water than by any other cause; and even in towns provided with a public water supply, many of the most alarming outbreaks of the

disease have been traced to contamination of the supply either at its source or in the course of its distribution through pipes and mains, or by the entrance of foul air from closets into periodically empty pipes when the water supply is intermittent. Thus at Guildford, in 1867, there was a severe outbreak of typhoid fever in a particular part of the town which was supplied for a short time with water from a certain high-standing reservoir, and this reservoir had been previously filled from a new well. This well was sunk through the porous chalk formation, and in close proximity to it were some sewers, one of which was found to be leaking in several places, and permitting the sewage to ooze into the well, the water of which was found on analysis to be contaminated and unfit for use, and was doubtless the cause of the outbreak. At Over Darwen, again, in Lancashire, there occurred another severe outbreak of the disease towards the close of 1874, which was traced to the leakage of a stopped-up closet-drain into the principal water main of the town, which it crossed; while at Lewes, during the same year, a similar outbreak was traced in the first instance to pollution of the town water supply, by water drawn from the Ouse, which receives the town sewage, but mainly spread by suction of polluting matter into the water-pipes of an intermittent water supply.

But as I have already said, it is in villages and country districts where the dangers of water pollution are rifest. The well is often in such close proximity to leaky drains or cesspools, that the wonder is that the amount of disease which is produced in this way, large though that be, is not much greater than it actually is. Nor is typhoid fever the only disease which owes its origin to polluted water. I have very often traced outbreaks of diphtheria to the same cause, as well as numerous cases of common ulcerated sore throats. To polluted water have also been

traced repeated outbreaks of what is called low fever, diarrhœa, and dysentery, while in districts where shallow dip-wells are common, it is very often found that children suffer from worms.

3. *Unsound Food.*—Perhaps of all articles of food, by far the largest amount of disease is produced by the agency of milk, and though it is only of recent years that the attention of the medical profession has been directed to this hitherto unsuspected source of mischief, there is a constantly accumulating amount of evidence which goes to prove that milk which has been tainted by polluted water has over and over again been the cause of well-defined outbreaks of typhoid fever; and among others may be mentioned the following:—A limited outbreak described by Dr. Taylor, of Penrith, which occurred in that town in 1870; an outbreak of a more extended nature which occurred in Islington, in the same year, and which was minutely investigated and described by Dr. Ballard; an outbreak at Armley, near Leeds, and one at Moseley, near Birmingham, both of which were investigated by Dr. Ballard, in 1872 and 1873; and lastly, several outbreaks which have recently occurred in Glasgow and its neighborhood, which have been minutely traced and fully described by Dr. Russell, medical officer of health for that city. In many of these outbreaks, the origin of the disease has been traced, not only to polluted water at the dairyman's house, but to water which further investigation has proved to have been specifically tainted by the germs of typhoid fever. In other words, it has frequently been found that the disease had broken out in the first instance in the dairyman's house, and that the cesspool or drain which received whatever came from the patient leaked into the well. But judging from my own experience, I am fully convinced that milk which has been tainted by polluted water, even though there be no

case of illness at the dairymen's house, is quite sufficient to produce typhoid fever, low fever, diarrhœa, or dysentery, and I have as little doubt that diphtheria and ulcerated sore throat can also be produced in the same way. Of course, the dairyman will as a rule only admit that the milk-cans have been merely washed out with the water; but there is always strong presumptive evidence that in all these instances the milk itself has been diluted to a greater or less extent with the same water.

Then, too, with regard to the infantile diarrhœa, which proves especially fatal during the summer and autumn months, it is now generally admitted, and, on my own part, I have no doubt of it whatever, that a large proportion of the deaths are due to milk which has either become tainted in this way, or becomes tainted by putting it into feeding-bottles which are seldom or never kept properly clean.

Another great danger attaching to milk as a carrier of disease depends upon the remarkable powers which it possesses of absorbing any effluvia contained in the surrounding air. If milk, for example, be kept in a badly ventilated place, where foul odors are perceptible, it will very soon become tainted and unfit for use, and on this account it ought never to be stored in sculleries or larders, nor should it be stored in vessels made of lead or zinc, because in the latter case it is liable to absorb such a quantity of lead as to render it poisonous. It is owing to this power of absorbing particles floating in the air that milk has frequently been the means of producing widespread outbreaks of scarlatina. If the disease exists in the dairyman's house, it is sure to be conveyed in this way to some if not all of his customers, and very often it would appear as if the infectiveness of the scales or other particles absorbed by the milk had become increased by this mode of conveyance.

When foot-and-mouth disease is prevalent, all milk should be boiled before being used, because it has been clearly proved that the milk of cows suffering from this disease, though frequently taken with impunity, is very apt to produce ulceration of the mouth with swelling of the tongue. It need hardly be said that the milk of any animals suffering from any acute disease or from inflammation of any part of the udder, is decidedly unwholesome and altogether unfit for use.

Such, then, are some of the more prominent dangers attaching to our milk supply, and the recent Order in Council with reference to the systematic inspection and sanitary condition of cowsheds and dairies, cannot fail to be productive of a vast amount of benefit to the public, and especially to children, if fairly and honestly carried out.*

Passing on now to the consideration of ailments induced by other articles of food, we have to note in the first instance that the evidence with regard to the effects of eating diseased butcher's meat is of a somewhat conflicting nature. Thus, in Scotland, it is common for shepherds and farmers and their families to eat what is known as *braxy*, or diseased mutton, with immunity; while it has been computed that as much as one-fifth of the butcher's meat sent into the Metropolis is diseased meat. While, therefore, there can be no doubt that the risk of eating diseased meat, especially if properly cooked, is not nearly so great as might be expected, there are numerous well-authenticated instances which clearly prove that there always is a certain amount of risk, and that the symptoms induced in this way are chiefly those of vomiting, diar-

* These attempts of our English cousins to discover by experiment the most practical methods for preventing injury to the public health from adulterated food, contagious diseases, &c., will, I hope, speedily instruct us how to most effectually provide by lew against similar frauds and dangers in the United States.—(B.)

rhœa, and a low kind of fever. The worst of it is that dishonest butchers make it their constant aim to palm off the carcasses of animals, as sound meat, which they have bought for a mere nominal sum to be slaughtered because they are suffering from an incurable disease, such as inflammation of the lungs, pleuro-pneumonia, and the like. In all such cases, I conceive it to be the duty of the medical officer of health to condemn such meat as unfit for human food, for the general protection of the public, even though the risk to health be small or doubtful.

With regard to animal food which has become more or less putrid, there is a similar amount of conflicting evidence. We all know that game is not considered fit for the epicure's table until it is in an advanced stage of decomposition, and beef and mutton are relished all the more if they have been allowed to hang until decomposition is slowly commencing. No doubt, thorough cooking is the main preventive of any mischief which would otherwise arise from decomposing animal food; but, in spite of this, instances are by no means rare in which symptoms, similar to those just enumerated, have been produced by food of this description. If, moreover, a person happens to have an ulcerated mouth or tongue, he runs the risk of suffering from actual blood-poisoning by the putrid food coming in contact with the ulcerated parts. Putrid or badly smelling sausages are especially dangerous, no matter how thoroughly they may be cooked.

The most distinctive diseases, however, induced by diseased butcher's meat, are those of a parasitic nature. The disease so common in Germany, known as trichiniasis, is caused by eating the flesh of animals, and chiefly the pig, infested with the larvæ of the *trichina.* When taken into the stomach in articles of food, such as bacon or sausages, which have not been properly cooked, it speedily develops into maturity, new embryos are produced in

enormous numbers, which make their way through the cellular tissue pervading all parts of the body. The disease, when thoroughly established, is incurable, and after death, the parasite is found twisted up in spiral form (hence the name, *trichina spiralis*), in numberless minute cysts, in almost every muscle of the body. Fever, rheumatic pains, and gradual emaciation, are the prominent symptoms, but they are often so vague and ill-defined, that the disease has not been suspected until after death. The disease is comparatively rare in this country, but on the Continent severe outbreaks have been by no means uncommon.

Of other diseases of a parasitic nature connected with food, may be mentioned tapeworm, which is induced by eating what is called measly pork, and hydatid disease of the liver and other organs.

Putrid fish will produce symptoms similar to those caused by putrid meat, and many people dare not eat shell-fish, because, though fish may not be suspected as unwholesome, they seldom fail to induce an eruptive disease of the skin, somewhat akin to nettle-rash, and accompanied by a slight amount of fever.

The disease known as scurvy is induced by the want of fresh vegetables, or vegetable juices, and a too exclusive use of salted meat. Before the days of Captain Cook—who was the first to demonstrate the real cause of the disease—scurvy decimated our crews alike in the navy and merchant service, and in recent years more than one serious outbreak on board ship has testified to the neglect of proper precautions. The great preventive against scurvy during long voyages is lime-juice, and all shipowners are bound by law to supply their crews with a liberal allowance of this substance, properly prepared, and in such condition as to satisfy the officers of the Board of Trade. Preserved vegetables of various kinds are also very valuable preventives, so that with the aid of

these and tinned meats, with occasional doses of lime-juice, the longest voyages may nowadays be undertaken without any fear of the disease breaking out.

As regards vegetable food, it need only be pointed out that all food of this description which has become fusty or mouldy is unwholesome. Mouldy flour or bread has been frequently known to produce distressing symptoms; while on the Continent, what is known as ergot, or spurred rye, when ground up with the rye, and made into bread, has been productive of serious epidemics. Owing to the operation of the Adulteration Acts, the adulteration of articles of food or condiments does not in the present day exercise such a deleterious influence on public health generally as it doubtless did a few years ago. There still, however, remains much to be done to carry out the provisions of the Act at present in force to any degree approaching efficiency. Public analysts have been appointed all over the country, but the public authorities appear to be sadly remiss in collecting samples to be submitted for analysis. Milk is still watered to a large extent, butter mixed with lard, vinegar fortified with sulphuric acid, pickles made attractive-looking and green by the addition of sulphate of copper, bread made white by the addition of alum, flour mixed with all sorts of mill-sweepings, beers fortified with salt and other ingredients, and spirits largely diluted with water. The chemist can nowadays detect all these and other fraudulent sophistications, and the public have themselves to blame if they do not insist that the machinery which the Legislature has provided to put a stop to them, shall not be allowed to remain any longer at a standstill.*

---

* Massachusetts has the honor of being first among the United States to provide public analysts for the purpose of checking the sophistication of milk, flour, etc., and the present rapid spread of enlightened public opinion in favor of sanitary reform will, we trust, lead to her excellent example being generally followed in every part of our Union.—(R.)

4. *Disease-Germs.*—It has already been pointed out, in the introductory chapter, that there are certain diseases known as zymotic, which, however they may have originated, are propagated by infection or contagion, and it is believed that the real agents are infective particles, or so-called disease-germs, given off by the skin, the lungs, or the bowels, as the case may be. It is likewise characteristic of these infectious diseases, that they generally breed true, and run a more or less definite course. Thus, the germs of small-pox can only induce small-pox, those of scarlatina can only induce scarlatina, and so on. In some the infective particles are given off by the skin and lungs, and as they are conveyed by the air, they adhere to articles of clothing, furniture, and the walls of the sick-room. Small-pox, scarlatina, measles, typhus fever, are all propagated in this way. In diphtheria and whooping-cough, the infective particles are conveyed by the breath, while in cholera and typhoid fever they are contained in the bowel discharges. Some of these diseases, such as measles, whooping-cough, and scarlatina, are especially fatal to young children, and one attack, as a rule, protects from any future attack. Old and young, when not sufficiently protected by vaccination, are alike liable to small-pox, if exposed to infection, while diphtheria, though it is more common among children, also attacks people in adult life. Typhoid fever and other kinds of fever, on the other hand, are more generally fatal to grown-up persons or to those who have passed the period of childhood.

It is further characteristic of almost all these diseases, that after the organic poison, or germs, have entered the body, whether through the air, by being inhaled into the throat and lungs, or through our food or drink, when contaminated, a certain period of incubation elapses before any special symptoms begin to manifest themselves. This period, though tolerably constant in some of the diseases,

such as small-pox, in which it generally runs to about twelve or fourteen days, varies from a few hours to several days; but, be the time long or short, the infective material is supposed to be multiplying in the system, and carried to all parts by the circulation of the blood, and thereby induces the particular symptoms by which the disease is recognized. If the system can eliminate the poison faster than it is reproduced, recovery generally ensues; but if, on the other hand, it continues to be reproduced faster than it can be got rid of, death is the inevitable result.

Beyond the brief explanation given in Chapter I. of the germ theory, I have purposely avoided all discussion concerning this or any other theory which tries to account for the origin or mode of propagation of these infectious diseases. Indeed, so conflicting are the views entertained by various writers concerning their nature, that "disease-germs," "infective particles," "organic poisons," are all of them terms which are used to indicate the infective or contagious material which, passing from the sick to the healthy, induce the special symptoms of the diseases in question. Then, again, "infection" and "contagion" are now used as synonymous terms, or, at all events, are used indiscriminately, and are intended to convey the same meaning. Of far greater importance is it to know that, whatever be the origin or mode of propagation of these diseases, they are to a very large extent controllable, and many writers even go so far as maintaining that, in the strict sense of the word, they are altogether preventable. Thus no one who has studied the subject fully and fairly can doubt that small-pox could be completely eradicated from our midst if every one were thoroughly protected by vaccination; and even apart from the protective influence of vaccination, it has been proved over and over again that if the first case or cases of an outbreak be at once removed to a hospital, where they can be properly isolated, there is

no difficulty experienced in stamping out the disease, because no fresh case can arise without the contagion being conveyed from a previously existing case. This is also true with regard to that other very fatal disease, scarlatina, though perhaps not to such an exclusive extent, inasmuch as there is reason to believe that scarlatina is sometimes originated *de novo* from bad water or foul effluvia, but, when once originated, becomes highly infectious. In all diseases of this class, therefore, isolation is one of the most important aids to prevention, and hence it is that sanitary authorities throughout the country are empowered to build hospitals for infectious diseases, and provide them with all the necessary appliances out of the public rates. The misfortune is, that except it be in large towns, there are few authorities who will provide hospital accommodation until some serious epidemic breaks out, when it simply becomes a case of "locking the stable-door after the steed has been stolen." But in addition to isolation, disinfection, and other precautionary measures, which will be more fully detailed further on, it cannot be too widely known that improvement of local surroundings is essential to the diminution or complete banishment of so-called zymotic or infectious diseases, not only because they are all largely fostered by insanitary conditions, but because there is an ever-increasing amount of evidence already referred to, which goes to prove that many of them have a birthplace exterior to man, but a birthplace in the festering filth which he allows to befoul the air which he breathes or pollute the water which he drinks.

For further details respecting infectious diseases and their prevention, the reader is referred to Chapter VIII.

CHAPTER IV.

FOOD AND DIET.

I. Nutritive Values of Foods.

We have already discussed, in Chapter II., the different chemical constituents of food, and the different purposes which separately and collectively they subserve in the animal economy. We have seen, for example, that the nitrogenous, or albuminous, constituents are mainly intended for the construction and repair of the tissues; that the fatty and farinaceous constituents are largely concerned in the maintenance of bodily heat and the production of animal force; that the saline constituents, besides aiding in the process of nutrition, are concerned in the consolidation of the tissues; and that water is the great solvent for the conveyance of the nutritive material and the removal of waste products. All these constituents, or bases, must be present in the food supplied, otherwise health cannot be maintained, or, indeed, life supported; and all of them are found in the vegetable kingdom, so that man, if he chooses, can supply his bodily wants by feeding on vegetable food alone. But in the flesh of animals which we consume as food, we have these bases further elaborated, and we find the materials of flesh, and

sinews, and bone, ready prepared for our purpose. In eating meat, therefore, we are utilizing the digestive powers of other animals, and are, in fact, economizing force in a certain sense, by employing their digestive apparatus to do for us what we could not do for ourselves without a greater expenditure of vital energy. In other words, the meat-eater's digestion is not taxed to the same extent as that of the vegetarian pure and simple, although it is quite true that the latter is often long-lived, strong, and healthy. In this, as in other questions affecting the well-being of the individual, personal peculiarities and requirements must be taken into account, although there are certain cardinal principles which apply to all alike.

Now it has long been taught by experience, and abundantly proved by experiment, that a health-sustaining diet should not only contain the several food constituents which have been named, but that the amounts and proportions of them cannot be widely departed from under certain uniform conditions without incurring injurious results. But as different articles of food vary greatly as regards their nutritive qualities, it is further evident that the quantity which is requisite for healthy sustenance must vary considerably too. Thus the Irishman, who subsists almost entirely on potatoes, which chiefly contain starch, very little nitrogen, and scarcely any fat, has to consume 10 lbs. to 11 lbs. daily, and to supplement his diet with a little buttermilk or bacon; while the Scotch laborer, who subsists mainly on oatmeal, requires a much smaller weight, since this grain not only contains a considerable amount of nitrogen, but also a fair amount of fat, as well as starch. On the other hand, the man who lives largely on flesh and bread, obtains the same food constituents, but in a much more concentrated form, and a weight of about 2½ lbs. of such food is equivalent, in nutritive value, to the Irishman's 10 lbs. of potatoes and extras.

Then it has to be considered that climate and the resources of a country determine to a very large extent the nature of the dietary. In tropical countries, for example, where less physical activity and heat-production are required, the inhabitants subsist mainly on farinaceous foods, such as rice, millet, and maize, with only a moderate quantity of fat, in the form of butter and vegetable oils. In Southern Europe, again, the staple food of the Italians consists chiefly of macaroni, legumes, rice, fruits, and salads, to which are added oil, cheese, and fish, but very little meat; while in Spain, the diet is somewhat similar. Proceeding northwards, we find that animal food is more extensively used, although in France and Germany vegetables constitute a much larger part of the national dietary than among ourselves. In the north of Russia, rye and oats form the staple food from the vegetable kingdom, combined with an increased quantity of meat; while in the Arctic regions, the inhabitants consume large quantities of blubber, in order to generate animal heat abundantly, and are compelled to live on animal food almost exclusively, because in so cold a climate vegetables cannot be cultivated. Thus man is clearly omnivorous, and it largely depends upon climate whether he should subsist mainly on vegetable or animal food, or on a mixed diet. In this country a mixed diet is preferable, though it is generally admitted that Englishmen err in consuming too much animal food.

The following table of what are called alimentary equivalents, which is copied from the late Dr. Letheby's work on "Food," will enable the reader to appreciate the wide divergence which exists between the nutritive values of the various articles of diet in common use. These equivalents have been calculated on the amount of nitrogen and carbon in the different articles which are available for nutrition, and as they have been deduced from a

large number of experiments and observations, they may be accepted as approximately accurate:—

	Grs. per pound. Carbon.	Nitrogen.
Split peas	2699	248
Indian meal	3016	120
Barley meal	2563	68
Rye meal	2693	86
Seconds flour	2700	116
Oat meal	2831	136
Baker's bread	1975	88
Pearl barley	2660	91
Rice	2732	68
Potatoes	769	22
Turnips	263	13
Green vegetables	420	14
Carrots	508	14
Parsnips	554	12
Sugar	2955	—
Treacle	2395	—
Butter-milk	387	44
Whey	154	13
Skimmed milk	438	43
New milk	599	44
Skim cheese	1947	483
Cheddar cheese	3344	306
Bullock's liver	934	204
Mutton	1900	189
Beef	1854	184
Fat pork	4113	106
Dry bacon	5987	95
Green bacon	5426	76
White fish	871	195
Red herrings	1435	217
Dripping	5456	—
Suet	4710	—
Lard	4819	—
Salt butter	4585	—
Fresh butter	6456	—
Cocoa	3934	140
Beer and porter	274	1

It should be explained here that the above list of

equivalents applies to articles in their uncooked state, and that as regards the different kinds of animal food, the meat has been boned. As this table contains almost everything which is met with in a common dietary, it becomes no very difficult matter to calculate the total amount of carbon and nitrogen which any such dietary yields, and to compare the results with other dietaries which have been calculated in the same way.

But as we know that in addition to maintaining the body in a healthy state, food is the sole source of the active energy displayed in work, exercise, and locomotion, it becomes at once apparent that the diet must be increased as the work increases, and hence the question arises—What is the minimum amount of food on which an average adult can subsist without detriment to health? This question has been satisfactorily solved after a large number of experiments made by the late Dr. Edward Smith, Dr. Lyon Playfair, and others, and taking the mean of all the researches, Dr. Letheby has given the following as the amounts required daily by an adult man for idleness, for ordinary labor, and for active labor:—

Daily diets for	Nitrogenous. Ozs.	Carbonaceous. Ozs.		Carbon. Grs.	Nitrogen. Grs.
Idleness	2.67	19.61	=	3816	180
Ordinary labor . .	4.56	29.24	=	5688	307
Active labor . . .	5.81	34.97	=	6823	391

And here I may state that the general correctness of these averages is fully borne out by a series of observations which were carried out by myself when officially connected with convict prisons, and they have also been confirmed by numerous experiments which have been made by various physiologists, to determine the daily amount of carbon and nitrogen excreted by adult men under different conditions of diet and exercise.

As regards the proportionate amount of separate food constituents, we have already seen (Chapter II.) that the

following quantities of water-free food are required by a healthy adult daily:—Albuminous substances (albuminates), 4½ ounces; fatty substances, 3 ounces; saccharine, or farinaceous, substances (carbo-hydrates), 14 ounces; and saline matters, 1 ounce. These quantities apply to food deprived of all water, but as so-called solid food contains on the average about fifty to sixty per cent. of water, the total daily amount, exclusive of liquids, would be about 40 ounces.

In the subjoined table, abridged from Dr. Parke's work, are given the analyses of different articles of diet in common use, by various analysts, to show the relative proportion of the several constituents:—

ARTICLES.	In 100 parts.				
	Water.	Albuminates.	Fats.	Carbo-hydrates.	Salts.
Butcher's meat of best quality, with little fat	74.4	20.5	3.5	—	1.6
Beef and mutton, as ordinarily supplied	75	15	8.4	—	1.6
Bacon	15	8.8	73.3	—	2.9
Salt beef	49.1	29.6	.2	—	21.1
White fish	78	18.1	2.9	—	1
Poultry	74	21	3.8	—	1.2
Flour	15	11	2	70.3	1.7
Wheaten bread of average quality	40	8	1.5	49.2	1.3
Rice	10	5	.8	83.2	.5
Oatmeal	15	12.6	5.6	63	3
Peas (dry)	15	22	2	53	2.4
Potatoes	74	1.5	.1	23.4	1
Cabbage	91	.2	.5	5.8	.7
Eggs	73.5	13.5	11.6	—	1
Cheese	36.8	33.5	24.3	—	5.4
Milk	86.7	4	3.7	5	.6
Butter	6	.3	91	—	2.7
Sugar	3	—	—	96.5	.5

Speaking in general terms, an adult may be considered to be taking sufficient for the ordinary requirements of healthy activity if he consumes in twenty-four hours the

equivalents of 1 lb. of meat, and 2 lbs. of bread. The English soldier on home service receives ¾ lb. of meat and 1 lb. of bread daily, and he buys about ½ lb. additional bread, and 1 lb. of other vegetable food. Such a diet is amply sufficient for any adult under ordinary circumstances of light employment; but should extra demands be made upon the physical powers, the diet must be increased or the health will suffer. Active laborers, such as artisans or agricultural laborers, consume about a fifth more nitrogenous food and twice as much fat as those engaged in light employment, while the farinaceous constituents are not increased. Navvies, on the other hand, and those who are employed at hard work, while they require more food, generally err in taking too much animal food, and neglecting vegetable food. With a fair allowance of milk, plenty of oatmeal porridge and oatmeal cakes, a little butter and cheese, potatoes, and other vegetables, a Scotch laborer will do as hard a day's work as any English navvy, and yet take very little butcher's meat from one year's end to the other. Such a diet is as nutritious, and much cheaper in country districts, than a diet in which butcher's meat is partaken of twice and often thrice daily.

In a standard or well-arranged diet, the proportion of the different constituents should be as follows:—Albuminates, 1; fats, .6; and carbo-hydrates, 3; and experience also shows that these are the proportions which man's unaided instinct has all along striven to maintain, so that when any particular food is deficient in any single constituent, it is generally associated with another which contains an excess of it. Thus, certain kinds of animal food which are deficient in fat, such as veal, fowl, and liver, are invariably associated with ham or bacon. So, too, we use melted butter with certain varieties of fish, or fry them in oil; while salmon, eel, and herring possess fat enough in themselves, and are eaten alone. Then, again, in making

puddings we mix butter, milk, or eggs with sago, rice, or tapioca; salad is dressed with oil; rice boiled in milk; cheese or butter is taken with bread; bacon is used with cabbage and beans; and so on. These combinations are alike indicated by science and experience, and if the just proportions are departed from, sound health cannot be maintained. If, for example, albuminates be continuously taken in excessive quantities, as is often the case with large meat-eaters, either a considerable proportion of the food is eliminated undigested, or congestions and enlargements of the liver are produced, and a general condition of plethora ensues. It is generally believed, too, that gouty affections are frequently induced in this way, and especially if active outdoor exercise is neglected. A large excess of albuminates, without other food, produces diarrhœa, general discomfort, and febrile symptoms; while excess of fatty and farinaceous substances leads to corpulence and fatty degeneration of the tissues. A considerable deficiency of albuminates, on the other hand, induces great muscular prostration, and feverish dyspeptic symptoms; whereas the deprivation of farinaceous substances can be borne for a long time if an abundance of fat is supplied. Hence it is that men can be fed on fresh butcher's meat for a considerable period without detriment; but, as already stated, health can be best sustained in this country, and the process of digestion is least interfered with, when the diet is mixed and properly proportioned as regards its constituents.

II. Choice of Food and Drink.

1. *Vegetable Foods.*—It will be interesting now to survey very briefly the vast range of materials which civilized man has at his command for purposes of food; and first we will commence with those derived from the vegetable kingdom. The most important of this group are the

cereals, or cultivated grasses, such as wheat, oats, barley, rye, maize or Indian corn, rice, and millet. Wheat, in the form of bread, has long been distinguished as "the staff of life." The structure of the grain, like that of all the other cereals, consists of a gritty and woody outer covering, which is indigestible, and which is got rid of after the grain has been ground, by sifting. In what is called "whole meal," or brown bread, the bran and pollards derived from this outer covering are retained, and though this kind of bread contains more nitrogen than white bread, it is seldom used except medicinally, on account of its slightly irritant effect on the intestinal canal. For general domestic use, seconds flour is practically the best, inasmuch as it is the most nutritious, but white bread is generally chosen in preference, because it is less likely to be tough or sodden, and is more palatable.

Bread should be evenly porous, and the texture should be firm, so that it can be easily cut into thin slices. New bread is tough and not so digestible as when the loaf has been allowed to cool and dry. The crust should be well baked and not burnt, and the crumb should neither be flaky nor sodden. The taste and smell should both be free from sourness or acidity, and unless there be a considerable quantity of bran in the flour, the color should be white and not dark-looking. Sometimes the dishonest tradesman mixes ground rice, glue, or alum with the flour, in order to make the bread more retentive of moisture, and when this is the case, the loaf becomes sodden and doughy at the base after standing for some time. The best bread is the slowest in growing stale, and the aerated bread, in which the dough is raised by forcing pure carbonic acid into it, keeps better than any. For those who bake at home, brewer's barm is the best yeast, when it can be procured fresh, or that known as German yeast; but several of the baking-powders answer very

well. Of biscuits there is an endless variety, but those made from flour and water only, as "captains" and "ship biscuits," are most suitable for travellers, because they keep the longest. Lastly, as derived from wheat, should be mentioned macaroni and other valuable Italian pastes. They are very nutritive, and not by any means dear, and when well-cooked, with milk or with cheese, make very palatable dishes.

Oatmeal is richer than flour in nitrogen and fat, and is therefore more nutritious. In the form of cakes, and cooked as porridge, it constitutes the staple diet of the Scotch laborer, and with milk, potatoes, and other vegetables, he need require little else for his sustenance from year's end to year's end. The coarsely ground Scotch meal is the most suitable and palatable. When cooked as porridge, the meal should be well boiled and flavored with salt. With good milk, it makes a most nutritious dish for children as well as adults, either for breakfast or supper, and it is to be regretted that it is not more generally used in the nursery and the homes of the poorer classes than it is. The grain, deprived of its husk, constitutes grits or groats, and when these are crushed they are known as Emden groats, and are used for making gruel, a drink which was at one time a favorite with our forefathers.

Barley meal is largely used in the north of Europe, and was the common food of poor people in England about the time of the Commonwealth. The grain is almost always ground whole, and the bread made from it is compact and heavy. It is generally mixed with equal parts of wheaten flour, or with oatmeal, to make it more palatable. Pearl barley consists of the grain deprived of its husk, and is much used for making broth. From barley, too, is derived malt saccharine, from which our famous English beer is brewed; and it is also largely used for the distillation of whiskey.

Rye meal, once a common article of diet among ourselves, is still largely used throughout Germany and Holland, and is well known to travellers as forming the dark, sour bread which is at first so distasteful to many. As regards nutritive quality, it is slightly less than that of flour.

Maize in various forms is often recommended as a valuable food, and is one of the most extensively used grains in the world. It is largely consumed by the inhabitants of South Africa, America, Danubian Principalities, Italy, Spain, south of France, and Mexico. The ration for a Kafir servant is three pints of Indian corn daily, and though he seldom gets anything else, he manages to thrive well on it. The grain contains a good deal of oily matter, and is rich is nitrogen, but the flavor is somewhat harsh. The meal does not make good bread, but it can be cooked in the form of cakes, or by stirring it in boiling water or milk, as in the case of porridge. There is a tender variety of Indian corn, called sugar corn, the head or ear of which is cooked whole and in the green state, and makes a very succulent dish, much lauded in America. Taking into consideration the price of maize, and its high nutritive qualities, it is certainly one of the cheapest, if not the cheapest, article of food for the poor.

Rice, though rich in carbon, is one of the least nitrogenous of all the cereals, and is not so nutritious as flour. In this country it is used only as an adjunct to other foods in the form of curry and pudding; but it constitutes the principal food of Eastern and Southern nations. Millet, like rice, is much used in Egypt, India, and the interior of Africa. It is slightly more nutritious than rice, but is hardly known in this country.

Amongst other kinds of farinaceous food sold as dietetic adjuncts, may be mentioned arrowroot, sago, and tapioca; but as they each consist almost entirely of starch, the

only preference which can be given to any one of them depends upon price and flavor. They are best cooked by mixing them in boiling water or boiling milk, and then allowing them to simmer for a minute or two.

The next group of vegetable foods which we have to consider are the pulses, or legumes, such as peas, beans, and lentils. The nutritive value of all of them is very high—the highest of all vegetable foods, since they contain more nitrogen than any of the cereals, and are as rich in carbon as wheaten flour. They are cultivated and eaten in all parts of the world, and are generally cooked with fat. In India, the Hindoo adds lentils to his rice and glue, and in this country we associate beans with bacon, and peas with butter. Peas and broad beans, when cooked whole, should be eaten young, and their skins should be tender enough to crack on boiling. When they are more matured, the skins become very tough and leathery, and the longer they are boiled the harder they get. Split or dried peas are deprived of their skins already, and if well boiled, as in soup or pudding, they make a very nutritious dish. The French, or haricot, bean, the fruit of the scarlet runner, which is such a favorite in this country in its green state, ought to be much more popular than it is in the dried state. When properly cooked and flavored, haricot beans make a very nutritious and a very cheap dish; indeed, there are some varieties which can be obtained in this country at about two-pence per dish. Then, again, lentils deserve to be much more generally used than they are. They make a very palatable and nourishing soup when flavored with a few pieces of celery or asparagus, and properly seasoned. As an illustration of the nutritive value of legumes, it may be remembered that during the Franco-Prussian war the German soldiers were supplied with a sausage named the *erbswurst*, which was made of peasmeal or pea-

soup mixed with a certain proportion of lard or bacon, onions, etc., and dried so as to be portable. Each sausage was a pound in weight, and one constituted the daily ration of the soldier. It was easily cooked by boiling in water, or it could be eaten cold. What is known as Revalentica Arabica consists of ground lentils and cocoa.

Among what may be called the succulent vegetable foods, the potato is by far the most important. It was introduced into this country by Sir Walter Raleigh on his return from Virginia towards the close of the sixteenth century, but did not come into general use for more than a century later. Its nutritive value is not great, containing as it does only twenty-five per cent. of solid matter, of which only about two per cent. is nitrogenous; but it possesses the great advantages of being easily cultivated, easily kept, easily cooked, and easily digested, and, considering its cheapness, it possesses the further advantage of being a very economical food. Potatoes are best cooked in their skins, and should be mealy and powdery. When they are close and waxy, as when very young, or when they begin to sprout, they are somewhat indigestible.

The Jerusalem artichoke, though a favorite with people who have gardens, has never become very popular in England, and indeed, it is not so nutritious as the potato. Turnips, carrots, parsnips, beets, onions, cabbages, leeks, asparagus, kail, cauliflower, are all pretty much alike in nutritive qualities, being made up of a large percentage of water, and containing only a small amount of nitrogen. They are all, however, very valuable as antiscorbutics, or blood-purifiers, and for their qualities of flavoring insipid foods and mixing up with strong ones. Salads, which should always be made from fresh green vegetables, may be so varied in respect to ingredients as to constitute an infinite variety of dishes. When fresh vegetables cannot

be obtained, preserved vegetables make very good substitutes in cooking.

Mushrooms are always best when grown in open meadows. They should peel easily, be of a pink color inside, and have a frill or curtain attached to the stalk. Fried with butter or fat, and properly seasoned, they make an excellent dish, and they also constitute a very palatable adjunct to stews. The large puff-ball makes very good ketchup, and may be cooked as fritters; while there are many other varieties of the *Agarici*, or mushroom-group, which are edible, and which would be used if they were more generally known. Allied to the mushroom may be mentioned the truffle, but this is only used as an expensive luxury.

Pumpkins, marrows, cucumbers, and various kinds of nuts help largely to support life in some countries. The banana and bread-fruit are also valuable esculents, the former containing about twenty-seven per cent. solid matter of about the same nutritive value as rice. The bread-fruit contains about twenty per cent. solid matter, and in its fresh state is cooked by first peeling it, then wrapping it in leaves, and afterwards baking it between hot stones.

Ripe fruits, such as apples, pears, oranges, strawberries, etc., though not of much nutritive value, are prized on account of their agreeable flavors. Dried fruits, such as grapes, figs, etc., which contain much sugar, are very nutritious, and in tropical climates are largely used for food.

Among other vegetable foods may be mentioned several varieties of sea-weed and lichens, but except it be in Arctic regions, they are very little used. Icelandic moss, when mixed with rye meal, makes a wholesome and nutritious bread.

Sugar and treacle are both extensively used on account of their flavoring qualities. They are heat-producing and

fattening agents, and their nutritive value in these respects is about the same as that of starch. Tea, coffee, and cocoa will be best considered subsequently as beverages.

With regard to pickles and numerous other condiments, little need be said. Their dietetic value depends not so much on their nutritiousness as on their flavoring qualities, by which they whet the appetite and act as aids to digestion. Pickles were at one time largely contaminated with sulphuric acid and sulphate of copper, but those which are now obtained from well-known manufacturers are generally pure and wholesome.

2. *Animal Foods.*—The foremost place among these must be given to milk, inasmuch as it is a complete food, containing all the constituents necessary for nutrition and growth. An infant requires nothing except the mother's milk for its sustenance during at least the first six months of its existence, or, failing that, cow's milk mixed with about a third of warm water and a little sugar. After this, when teething has commenced, farinaceous food may be given in small quantities, but during early childhood, milk should continue to be the staple article of diet. Human milk and cow's milk differ but little in composition, except that cow's milk contains more casein, and woman's milk more sugar. They cach contain about eighty-seven per cent. of water, and the solids consist of casein, butter, sugar of milk, and various salts. In Switzerland, goat's milk is used; in Sweden, sheep's milk; in Lapland, reindeer's milk; and in Turkey, mare's milk.

The quality of cow's milk varies according to the breed of the animal, the nature of the food, and the time of milking—the evening milk being always richer than that milked in the morning. When milk is allowed to stand for some time, the cream, which contains most of the fat, or butter, rises to the top, and when this is re-

moved, the milk is called skim-milk. Butter-milk, on the other hand, is the residue of the milk or cream after the butter has been removed by churning. It is much poorer in fat than skim-milk, but it is nevertheless very wholesome and nutritious, and in summer makes a very refreshing drink. To have it thrown away as food to the pigs, instead of being sold or given away to poor people in the neighborhood, is, to say the least, a very regretable waste. By adding rennet or acid, milk coagulates, and the curd is used for making cheese. The liquor which is left after the curd has been removed is called whey, and though not so nutritious as butter-milk, it still holds a small amount of casein in solution, as well as sugar and salts, and makes a very refreshing drink, easily digested and rapidly absorbed. In composition it very much resembles the serum of the blood, and a grate of nutmeg makes it very palatable. In some parts of Switzerland, it is administered medicinally at certain establishments largely advertised for the "whey-cure."

In condensed milk, about sixth-tenths of the water is evaporated, and sugar is added as a preservative. It is very valuable as a food for infants when good cow's milk cannot be obtained, but should be diluted with three times its volume of water before it is used.

Milk is very often adulterated with water, and if the water is pure and wholesome, little harm is done, except that the mixture is less nutritious; but when the water is contaminated, as too often happens, typhoid fever, diarrhœa, and other serious disorders, as has previously been shown, are frequently induced. Another great danger attaching to milk as a carrier of disease depends upon its remarkable powers of absorption, whether it be of foul effluvia or disease-germs. Outbreaks of scarlatina have been repeatedly traced to the agency of milk, and there can be no doubt that much of the infantile diarrhœa,

which proves specially fatal during the summer and autumn months, is due to milk which has become tainted by being kept in close and foul-smelling places, in insufficiently cleansed vessels, or in feeding-bottles which are seldom properly washed. The disease called thrush is often caused by the neglect to keep feeding-bottles clean. Indeed, there are so many hidden dangers in the use of milk, especially among careless and filthy people, that to ensure safety it should always be boiled in warm weather, and in districts where foot-and-mouth disease is prevalent. Milk should never be stored in sculleries or larders, or in vessels made of zinc or lead; in the latter case, it speedily absorbs salts of the metal, and becomes poisonous. It need hardly be said that the milk from diseased animals is decidedly unwholesome.

The purity of our milk supply is a question of such extreme importance that the Legislature has wisely insisted on the inspection and wholesome condition of dairies, and, like other articles of food, provision is made to submit samples to public analysts for examination when adulteration is suspected.

Pure cow's milk, when placed in a tall narrow glass vessel, should be perfectly opaque, of a full white color, free from deposit, and should yield from six to twelve per cent. of cream by volume. It should have a pleasant taste, be free from acidity, and have no disagreeable smell. By using a graduated glass vessel and the lactometer, one can judge with tolerable accuracy whether the milk is genuine or not.

Butter, like milk, is often adulterated with water, which may be detected by boiling—the oily matter floating on the top, leaving the water underneath. It is also adulterated with lard and other animal fats, in which case it will be found that it does not melt evenly. Good butter should give no unpleasant or rancid taste, and when

melted should yield a clear-looking oil, with little deposit of water or other substance.

Cheese is used for two purposes—one for giving a fillip to the palate, in which case it is preferable if rich and decayed; and the other, that it may serve as a substantial food. In nutritive power, and especially in nitrogenous matter, it ranks high as an article of diet, but considering its price, it is hardly so economical as many other kinds of food. Skim-milk cheese, when it can be obtained cheap, makes, however, a very good adjunct to the laborer's loaf of bread.

We now pass on to the consideration of butcher's meat. Perhaps of all European nations, the English people are the largest consumers of animal food, nor can there be the slightest doubt that the well-to-do classes consume much more meat than they actually require. Indeed, the sole idea which the working classes possess with respect to improvement of diet following upon increase of wages, is the inordinate use of butcher's meat, and when they can afford it, they make this the principal element of at least three meals daily.

As regards nutritive value, butcher's meat varies very much according to the proportions of fat and lean; but it matters very little whether the meat be beef or mutton. In store animals the proportion of the lean is always greater than the fat, while in fat animals the fat is always very considerably in excess of the lean. Indeed, the main result of the fattening process is to substitute fat for water in the carcase; and the quality of the meat depends upon the free intermixture of streaks of fat with muscular fibre.

The following are the principal characteristics of good butcher's meat:—The lean on the cut surface should show a deep purplish red tint, and in beef should be marbled with fat, which shows that the animal has been well fed.

In mutton the cut surface should have the same purplish tint, but should be quite even in hue throughout.

The color of the muscle should neither be too pale nor too dark. If pale and moist, it indicates that the animal was young or diseased; and if dark or livid, it shows that in all probability the animal was not slaughtered, but died with the blood in it. Both muscle and fat should be elastic, yet firm to the touch, not moist or sodden, and the fat should be free from blood-specks. The raw fat of beef should be of a light yellow color, like that of butter, while the fat of mutton should be very white. The muscular fibres should not be large and coarse, nor should there be any gummy or purulent-looking fluid in the cellular tissue. The surface of good meat should be perfectly dry, and even the cut surface should scarcely wet the finger.

The muscular fibre of a beast in poor condition or wasting from disease is pale in color, and a quantity of watery fat of bad color is mixed up with the fasciculi. The meat itself is wet, flabby, and inelastic, and pits when the point of the finger is pressed against it. Such meat, it need hardly be said, is unfit for human food.

The odor of good meat should be slight and not by any means disagreeable. An unpleasant odor indicates commencing putrefactive change or that the meat is diseased. A very good plan to detect any unpleasantness of odor is to thrust a long clean knife into the flesh, and smell it after withdrawal.

In lamb and veal, the lean should be pale, but evenly tinted and free from mottling, while the fat in both should be very white and translucent.

The internal parts, such as the heart, liver, kidneys, lungs, sweetbread, should have no unpleasant smell, and be free from spots of congestion or bruises. As they decompose much more rapidly than the flesh of the carcases, they should not be kept long before being cooked,

and when cooked should not be subjected to a very strong or prolonged heat, because it makes them hard and indigestible.

The amount of bone in meat varies very considerably, but on the average it is not less than eight per cent. In shins and legs of beef it amounts to one-third, and sometimes to one-half the total weight, while in the neck and brisket it amounts to about ten per cent. The most economical parts are said to be the round and thick flank, then the sticking-piece and brisket, and lastly the leg, while in the case of mutton and pork the leg is most profitable, and then the shoulder. Sheep's head makes excellent broth, and ox-head very good soup; but both require long boiling to extract the whole of the nutriment. If boiled for eight hours, ox-head will yield about one-fourth of its weight in gelatine, and the cheek will furnish nearly four pounds of good meat. Shins of beef also make excellent soup, but, like ox-head, require long boiling. Even bones when stript of the meat contain a considerable amount of fat and nitrogenous matter, so that six pounds of bones, when broken up and boiled for nine hours, will yield an amount of nitrogen equal to that contained in a pound of meat and twice as much fat.

In some parts of the Continent, horse-flesh is regularly sold in the open markets, and by many is considered to be superior to beef. American beef and mutton are now largely imported into this country, and are quite as palatable and nutritious as the average of joints to be obtained from English butchers. Indeed, English mutton is too frequently over-fat and over-grown; good mutton, like Welsh or Scotch mutton, is generally small. Venison and the flesh of other wild animals differ very little in nutritive quality from butcher's meat, except that they are leaner, and contain more blood; as a rule, they are more digestible.

Bacon differs from meat in the relatively large proportion of fat and small proportion of water. It is a great favorite with all classes, on account of its flavor, its facilities for cooking, and because it is easily kept and is always handy. As it is rich in carbonaceous food, it forms a suitable adjunct to substances which are rich in nitrogen, such as veal, poultry, rabbits, eggs, beans, peas, and lentils; its flavoring qualities can make many a dish of homely vegetables palatable as well as nutritious. Although American bacon is coarser and not so much relished as English bacon, it nevertheless deserves a ready sale on account of its cheapness.

As regards poultry, the chief virtue is tenderness. A young and tender bird may be known before plucking by the largeness of the feet and the leg-joints. When, on the other hand, a fowl appears on the table with a thin neck and violet thighs, it is wise to decline being helped to the leg, because these are sure signs that the fowl is old and tough. The same violet tinge may be observed in the thighs of old turkeys, which are also characterized by their hairiness. The age of geese and ducks may be best tested by their beaks, the lower part of which can easily be broken away when the birds are young. Apart from special points known to the sportsman, game may be roughly selected according to the same rules as poultry. Neither should be too fat, because in cooking the oil of the fat is apt to become rank and indigestible.

In purchasing fish, care should be taken that it is always fresh, and the best points to look to are the fulness of the eyes and the pinkness of the gills. There should be no offensive smell, which it must be remembered is frequently masked by the use of ice.

The different varieties of white fish, such as cod, whiting, haddock, turbot, plaice, and sole, contain only about twenty-two per cent. of solid matter, eighteen of which is

nitrogenous, and in order to increase their nutritive value they require to be supplemented with butter. Salmon, mackerel, eels, herring, and trout, however, are richer in fat, and are therefore more nutritious. Shell-fish only contain about thirteen per cent. of solid matter, and proportionately as little fat as white fish. Some varieties, such as whelks, mussels, and limpets, are rather difficult of digestion; but lobsters, crabs, periwinkles, and cockles are more easily digested, and oysters more so still. Caviare, the roe of the sturgeon, is best when obtained in the fresh state. The black, hard-looking fish jam, which is sold in pots, may be reckoned a great delicacy, but it is scarcely fit for human consumption.

The only variety of reptile of dietetic importance is the turtle, and although it is generally regarded as a mere luxury, it is in reality very digestible and nutritious, and makes excellent soup. Owing to the limited demand for it in the market, it is very dear, but nature supplies it in immense quantities, and the creature is so tenacious of life that it could be readily imported at a trifling cost. Dried turtle fins, which are not very expensive, make a good, nutritious soup, but they require to be soaked at least twenty-four hours before they are cooked.

Eggs contain about twenty-six per cent. solid matter, fourteen of which are nitrogenous. The yolk is the part which contains the fat, the white consisting of albumen and water. Owing to their deficiency in carbonaceous matter, eggs consort well with oil in salad, fried bacon or ham, and farinaceous puddings. In order to test whether eggs are good or not, a good plan is to make a solution of common salt and water (one ounce of salt to half a pint of water), when it will be found that in brine of this strength, a fresh egg will sink and a bad one float. If held up to a candle, a fresh egg will also be found to be more transparent than a stale one. Eggs may be pre-

served for some considerable time by rubbing them well with fresh grease or lard when taken from the fowl-house; or by plunging them into boiling water, so as to coagulate a thin layer of the albumen underneath the shell; or by putting them, when quite fresh, into milk of lime.

Both meat and fish of various kinds are now largely preserved in tins, and though they can hardly be considered to be as digestible and nutritious as when obtained fresh, they make very good substitutes, and possess the advantages of being readily cooked, and cheaper in price. Among these preserved foods may be mentioned "Liebig's extract of meat," which is especially valuable to invalids and travellers. Its nutritive qualities are inferior to those of good beef-tea, but it can often be taken by an invalid when beef-tea is rejected, and to any one suffering from fatigue it is very restorative.

Tinned meats, as a rule, are somewhat over-cooked, but they are so much cheaper than fresh meat that, on the score of economy alone, they deserve to be extensively used. They are best used cold, or warmed and mixed with vegetables, to form a stew, or they may be minced, and, when warmed and if well-seasoned, may be rendered very palatable.

The special diseases which are apt to be induced by unsound food have already been discussed in the previous chapter, and it only remains to refer, before concluding this part of the subject, to the saline constituents. As previously stated, these consist chiefly of phosphates and sulphates of potash, lime, magnesia, small traces of iron, and common salt. With the exception of the last, the other saline matters are contained in sufficient quantity in the ordinary articles of diet, but common salt is not present to any large extent, and has, therefore, to be added. Its dietetic value has been recognized from the earliest times, it exists in all the excretions, and it forms

about one-half the total weight of the saline matters contained in the blood.

3. *Water, Beverages, and Stimulants.*—It has already been pointed out that, exclusive of the water contained in the ordinary articles of diet, the amount of water required by an adult daily, taken pure, or mixed with other liquids, need not exceed thirty ounces or at the most a couple of pints. But as a rule, this quantity is greatly exceeded, by even the majority of so-called temperate persons. Thus, it is no unusual occurrence for a man to drink a pint of tea or coffee at breakfast; a pint of ale in the forenoon; a couple of glasses of sherry or half a pint of claret-and-water at luncheon; a pint or more of wine and other drinks at dinner; half a pint of tea or coffee afterwards; and at least another half-pint of some aerated water, with a little spirit, as a "nightcap," before going to bed. Altogether, therefore, it would appear that the quantity of liquid imbibed by most persons during the twenty-four hours, amounts at the very least to about five pints, or three times as much as is needful for health; and as a consequence, the excreting organs become overtaxed, the blood becomes thin, and the general tone of the system deteriorates much more rapidly than it otherwise would. But apart from the quantity, it is of still greater importance that the quality of the water consumed should be free from excess of saline substances, and otherwise uncontaminated. We have already considered, in the previous chapter, some of the more fatal of the many disorders which are developed in this way, and hence it is unnecessary to again refer to them here. Unfortunately, it only occasionally happens that people have a chance of choosing the kind of water with which they are supplied, and even then they are often ignorant of the dangers of pollution to which it is exposed. In towns, the water supply is public, and though it may be of good quality

when it enters the mains, it often becomes contaminated in cisterns or in the mains before it is used in the household. In country districts, again, well-water or water from small streams is chiefly relied on, and the risk of pollution becomes greater still.

Of course, the purest water is that condensed from steam, as sometimes manufactured on board ship, but it tastes flat and metallic, and, like roof-water, is apt to become impregnated with lead, if stored in leaden cisterns. Roof or rain water, too, is liable to contain an excess of solid particles washed off from the surfaces where it is collected, and hence it should always be filtered. In other respects it is wholesome, though not so palatable or refreshing as good well or spring water, but it is excellently adapted for cooking and washing purposes. Spring and well waters are often very hard, but become softer on being boiled, owing to the lime contained in them being thrown down as a deposit. Very hard waters are unsuited for cooking and washing, and have a tendency to render the skin harsh, arrest digestion, and induce gravel or stone. River and shallow well waters are liable to become polluted with sewage or other organic matter, but spring and deep-well waters, though generally harder, are as a rule much safer, because not so much exposed to these dangers.

The qualities which should most commend a water, independently of its source, are the following:—It should be soft, clean, clear, inodorous, sparkling, and sufficiently impregnated with saline substances to be tasteless. When there is reason to suspect a water which is used for dietetic purposes to be impure, it should either be sent to an analyst at once, or complaint should be made to the sanitary inspector of the district in order to have it examined.

Mineral waters, which are used for drinking purposes, and not medicinally, should also possess the same virtues.

In this country, all the best manufacturers of aerated waters have their own deep wells, and the waters which they produce are pure and of excellent quality; but at the same time, it cannot be too widely known that there are large quantities of cheap ginger-beer, lemonade, soda-water, and other drinks, which are made from water of doubtful quality, by persons who pay no attention to cleanliness, and who employ chemicals and flavoring materials, which are positively injurious. When, therefore, these aerated waters are used for dietetic purposes, they should always be obtained from well-known manufacturers, or the ordinary household water, if of good quality, may be aerated by using one or other of the many gazogenes which are now in the market.

When people are travelling, the only safe water to drink is a natural mineral water, because there can be little doubt that the attacks of fever from which travellers abroad are so liable to suffer, are more frequently induced by drinking bad water than by any other cause. In Germany, Apollinaris and Seltzers can generally be obtained; in France, St. Galmier; in Austria and Bohemia, Gieshübel; and in most Italian hotels, either St. Galmier or a natural Seltzer. The foreign manufactured aerated waters, and particularly those contained in the *Siphon*, are of doubtful quality, and should be avoided. Potash and lithia waters should only be used by invalids or those with a gouty tendency; indeed, any mineral water, whether natural or not, which is vaunted as possessing medicinal properties, should never be used for dietetic purposes.

It should always be remembered, too, that if a water is contaminated, neither admixture of wine or spirit, nor filtration, will make it safe to drink; but it may be rendered harmless by boiling for half an hour or so, and this result is readily attained in any place by making weak

tea, toast-and-water, barley-water, gingerade, or lemonade, and drinking the beverage cold.

An excellent drink for laborers, especially when employed at very active work, may be made from oatmeal and water, with a little salt to flavor. It is nourishing as well as refreshing, and is infinitely to be preferred to common beer to allay thirst. Toast or barley-water makes a good substitute, and many prefer treacle-water, but it should not be made too sweet.

With regard to other beverages, a few words must now be said concerning those very important dietetic adjuncts, tea, coffee, and cocoa. Although tea is very refreshing and largely used as a diluent at meals, as well as a drink, there can be little doubt, judging from the shameful way in which the trade is at present carried on by offering prizes and premiums to purchasers, that large quantities are adulterated or of very inferior quality. The best tea is that which possesses the best aroma and is pleasantest to the taste of the educated customer. The sedative, or soothing, qualities for which tea is prized are contained in the leaf, and consist of an essential oil, which may be smelt strongest in the best, and weakest in the inferior sorts. Indeed, good tea should yield a pleasant aroma alike in the dry state and when infused in boiling water, and the flavor of the infusion should be agreeable. Very often the bloom or glaze of green and black tea is produced artificially. In the case of black tea, it sometimes consists of a coating of black lead; and in that of green tea, it is not unusually a mixture of Prussian blue, turmeric, and China clay. Moreover, inferior mixtures, such as Moning Congou, Maloo mixture, Pekoe siftings, and the like, are largely imported into this country, and consist chiefly of exhausted tea leaves, leaves of other plants, iron filings, and the dust and sweepings of the warehouses. If strong "black tea" has an inky taste, a magnet will

10

detect any adulteration with iron filings. The purest teas color the water least; indeed, the best yellow tea, which comes overland through Russia, imparts only a very slight tinge to the infusion.

Excessive tea-drinking, especially during the afternoon and late in the evening, is very liable to induce dyspeptic ailments and very depressing nervous symptoms. Partaken as it often is, at all hours of the day, by the wives of the laboring classes and needlewomen, it becomes a fruitful cause of many of the disorders from which they suffer. When strong tea is indulged in late at night, it induces sleeplessness and disturbed rest. When taken as a drink, it ought always to be weak and allowed to cool.

Coffee is not so astringent as tea, and with some persons it is not so liable to affect the nervous system injuriously. In order to obtain it of good quality, it is advisable to purchase the beans fresh-roasted and grind them at home, or, better still, to purchase the raw beans and roast them over a charcoal fire immediately before they are ground. The ground coffee sold by grocers is very often mixed with chicory, and though this mixture is not unwholesome, the beverage is weaker in quality, and does not possess the agreeable aroma of really good coffee. The presence of chicory may be detected by sprinkling a portion of the suspected sample on the surface of water, when the coffee will float and the chicory sink. The presence of chicory is also indicated, if, on opening a packet of coffee, the contents are found to be caked or show any signs of caking.

As regards cocoa, the nibs are the most eligible form in which the plant may be used as a beverage; but when it is required as a supporting food, it is preferable to use the preparations of cocoa or chocolate sold by well-known manufacturers. These are much more nutritious than either tea or coffee, and are not so enervating. Indeed, there are few foods so nutritious as cocoa and milk, and

it is to be regretted they do not meet with more favor among the poorer classes.

We now pass on to consider very briefly the dietetic position which should be accorded to stimulants, or alcoholic beverages. The physiological effects of alcohol, and its terrible potency as a cause of disease, have already been fully discussed in a previous chapter; but, admitting that alcohol may be taken in small quantities without injury, and often with benefit, it remains to be considered in what form it should be taken, whether as wine, beer, or spirits, and under what limitations.

And first, it has to be pointed out that, no matter under what guise alcohol may be taken, it has been tolerably well established, by the experiments of the late Dr. Austie, Dr. Parkes, and others, that the quantity which may be consumed daily without any appreciable detriment, ought not to exceed 1½ ounces of pure, or absolute, alcohol. This is equivalent to 2½ pints of weak table beer, containing only 3 per cent. alcohol; or 1½ pints of stronger ale or cider, containing about 5 per cent. alcohol; or about ¾ pint of light claret, Burgundy, or hock, containing about 10 per cent. alcohol; or about 6 or 7 fluid ounces of port or sherry, containing from 20 to 25 per cent. alcohol; or about 3 fluid ounces of spirits, containing on the average 50 per cent. alcohol. A good-sized sherry glass, therefore, which holds about three ounces, will contain as much spirits as may be consumed habitually and with safety during the twenty-four hours. No doubt there are vast numbers of people who constantly exceed these amounts, and without apparently suffering in health; but on questioning them closely, it will often be found that headaches, general *malaise*, mental depression, and other uncomfortable symptoms are frequently endured as a matter of course, and without eliciting any complaint.

Distilled spirits are in every respect the worst form in

which alcohol can be habitually consumed, and if partaken of freely, the strength or frequency of the dose has to be gradually increased to produce the desired effect of comfort or exhilaration. Their use, therefore, ought to be carefully restricted, and the safest plan is to limit it to the "night-cap," when that is required; but most people would sleep more soundly if even that were dispensed with. Unfortunately, the great bulk of the spirits which are consumed contains a considerable amount of fusel oil, not to speak of raw spirit, which makes them injurious even when taken in the smallest doses. Those who take spirits, therefore, should be careful to obtain them good and well matured. It will be found, too, that spirits are better tolerated in the winter than during summer, and in bracing and colder climes than in warm or relaxing places. A great deal also depends on the amount of exercise taken; but even the sportsman on the moors will find that he will shoot more steadily and stand a much better chance of making a good bag if he "fights shy" of the whiskey-flask during the day.

As regards wines, much will depend upon whether the consumer intends to use them as a regular beverage or a luxury, and whether he has any gouty or dyspeptic tendencies. Beyond all question, the cheapest and best wine for daily consumption as a beverage is good sound claret. No wine can be more perfect than the greater part of the low-priced *bourgeois* wine from Bordeaux, which is now so common in the English market; and it is often far more wholesome than some of the wines which are sold at much higher prices under fanciful names.

Strong, full-bodied wines, such as port, sherry, Madeira, should rarely be used habitually, not only on account of the amount of alcohol which they contain, but because they are apt to derange digestion, produce acidity of the stomach, and, in the long run, generate gout. Sweet

wines are still more to be guarded against; they are only fit to be drunk occasionally, and in small quantities. The choicer Rhine wines do not bear carriage well, and though wholesome enough where they are produced, are too often deteriorated by being brandied in this country. Among sparkling wines, good champagne, when well matured, and with a minimum amount of alcohol, is the wholesomest; while, owing to the rapid absorption of its vinous ether, diffused by the carbonic acid, it possesses remarkable exhilarating properties. But for gouty persons, champagne and other sparkling wines are far from suitable; indeed, I am strongly of opinion that champagne, even of good quality, is as gouty a wine as port, Madeira, or rich brown sherry.

When it is desired to obtain fine wines of good vintages and unexceptional character, the purchaser, if not a connoisseur, must either depend upon a wine merchant of established reputation to supply them, in which case he has to pay a high price, or he has to look out for vintages of good repute, select his samples when they are just fit to bottle, and then lay them down, and keep them until they become matured and fit for use. By making constant and well-selected additions, year after year, a man's cellar after a time becomes a valuable and interesting part of his establishment, adding not only to his own enjoyment, but what to a genial host is more pleasurable still, gratifying appreciative friends at his well-selected dinner-parties. But no matter how good the wine, it ought to be taken sparingly, and not glass after glass for the mere sake of drinking it. In this, as in all other questions of luxury rather than requirement, every man ought to deal honestly and fairly with himself, watching the effects on body or mind of any tendency to excess, and rigidly denying himself if he is satisfied that he suffers in consequence of indulgence, however moderate that may be. Indeed,

it is a wise experiment, and one which does not entail any great amount of hardship or discomfort for most people, to try total abstinence for a period of two or three months. They would then learn more of the practical bearings of these agents in their relation to health, than any amount of mere book information which can be laid before them.

Of all alcoholic drinks, good light beer is perhaps the safest and wholesomest beverage for those who can take it. To men, however, who have reached middle life, and whose occupation is mostly indoor and sedentary, it is unsuited, because it is apt to derange the digestion and induce gouty symptoms. Those who lead active outdoor lives can generally take it with impunity, provided they do so in moderation, until long past middle life; but the great majority of professional and business men find they have to give it up altogether, or take it very sparingly when they have reached the age of thirty-five or forty. In Germany it is consumed freely at all ages, but German beer is usually much lighter than English beer, and contains less alcohol. Gouty persons, and those who suffer from rheumatism, should give it up altogether.

The great thing to be guarded against in malt liquors is hardness, or acidity. Unfortunately, however, a very large amount of the beer which is consumed by the working classes contains a considerable amount of acetic acid, even when it is brewed, and of course becomes more acid the longer it is kept. With respect to this point, a physician of large experience has remarked that "there is no more fruitful source of gout, rheumatism, diseased heart, dropsy, and the consequent early death of the robust working man, than this beer just on the turn and ready to become thick vinegar in the stomach." The enormous quantities, sometimes as much as two gallons a day, which agricultural laborers consume at hay-time and harvest, are productive of much evil, physically as well as morally;

and it is a good sign of the times that many farmers are now refusing to give beer as part payment. As already pointed out, oatmeal-water would be more refreshing and sustaining, or even cold weak tea or coffee. As the beer which is supplied often contains an excess of salt, instead of allaying thirst it increases it, so that the larger the quantity drunk the greater becomes the thirst. There is no doubt that beer and ale, like most wines, are to a certain extent nutritive, and often act as aids to digestion. They contain sugar and extractive matters which are utilized as carbo-hydrates, and have therefore a tendency to fatten; as well as a considerable amount of saline matter. Spirits, on the other hand, are for the most part merely flavored alcohol, and as they do not contain the ingredients which give dietetic value to wines or beer, their habitual use should be discouraged, and even their occasional use largely restricted.

III. Preparation of Food.

It is to be hoped that the introduction of cookery as a subject of instruction in some of our public elementary schools will speedily be followed by a widespread reform in the art of preparing food so as best to sustain the wants of the body without excess on the one hand or deficiency on the other. For, at present, it must be confessed, the errors lie on every side. Not only is there general ignorance with regard to the nutritive qualities of different articles of diet and their relative market price, but the food which is eaten often loses half its value by the faults displayed in its preparation. Hence amongst all classes there is constant and deplorable waste. Among the rich the sole aim of what is called good cookery appears to be to tempt the eater, by a succession of savory and highly seasoned dishes, to consume a huge excess of food; while among the middle and poorer classes, living and cooking

alike go "by rule of thumb," with but little variety in the diet, day after day, and the food too often cooked in such a way that ready digestion becomes an utter impossibility, and a large portion of the nutriment is wasted. Every one will acknowledge that in large kitchens the amount of broken victuals, crusts, bones, scraps, and so forth, which are literally flung away, much of it thrown into the dust-bin, would be sufficient to feed many a poor family; and among the middle classes there is the same want of economy displayed, though not to such a large extent. Of course, there is the usual outcry about servants, but the fault lies more at the door of the masters and mistresses. As a rule, the cook can defy her mistress, or, at least, have her own way in everything, because, ignorant as she herself is about the principles of diet, she is perfectly well aware that her mistress is more ignorant still, and knows absolutely nothing about how to cook even the simplest dish. And the only remedy for this state of things, so far as one can judge, is for the ladies of the present day to endeavor to do as their grandmothers did, and make themselves thoroughly acquainted with the details of cookery and household management.

But not only is there this needless waste of food everywhere, there is also constant waste of fuel. Although there are now numerous excellent kitchen-ranges in the market, and other apparatus for cooking, which would more than save their prime cost in the first year of use, many householders prefer to cling to the old kitchen-range, with its dust and soot and roaring fire. During the summer, especially, the economy in fuel would be very considerable if gas cooking-ranges, or ranges heated by burning oil, came into more general use. They are made of all sorts and sizes, and are much more cleanly than the ordinary kitchen-range. Then there are other apparatus, such as Warren's cooking-pot, which ensure less loss of

weight in cooking, and, by preventing dispersion of heat, effect at the same time a very considerable saving in fuel.

Of course, it need hardly be said that, no matter what the apparatus, scrupulous cleanliness should always be attended to in the kitchen, as well as in other parts of the house. A dirty, greasy-looking cook generally implies a dirty and untidy kitchen, and if the wife is untidy too, it is no wonder that the husband prefers to have his meals and spend his evenings from home.

In the homes of the poor, the cooking appliances are generally of the most imperfect kind, so that their meals are not only scanty, but wretchedly cooked. They have, therefore, to resort to the cook-shops of their neighborhood, which are as dirty as their homes, and the fare meagre and unsavory. In order to supply the crying wants of the poor in this respect, a movement has of late years been set on foot in most of our large towns, to establish restaurants, where meals may be obtained at the very lowest prices consistent with ensuring a small profit after paying costs; and certainly the bill of fare provided at many of these establishments is not only very reasonable, but very wholesome and palatable. The usual practice at these places is to supply daily a variety of dishes, both hot and cold, at the fixed charge of a penny a ration, and these rations, or dishes, consist of soup, broth, potatoes, greens, bread, cold pressed beef, ham, butter, coffee, tea, pudding, and cheese. A ration of meat generally costs a half-penny extra; and in order to get rid of the whole of the soup, which is made daily, it is the custom to sell the surplus stock at half-price after six o'clock in the evening. At many large manufactories and workshops, similar arrangements are provided for the work-people, and it is to be hoped that those who have been so instrumental lately in establishing coffee taverns for the purpose of

supplanting gin-palaces, will see the expediency of supplementing the taverns with cooking-depôts.

In the poorer localities of most large towns, soup-kitchens have been started for the really destitute. They are not intended to be self-supporting, like cooking-depôts, and the food is either distributed gratuitously by tickets, or at rates of charges much below prime cost. If only one kind of food is provided, such as soup, it should be varied from day to day, and differently flavored by using different kinds of vegetables. Flour or ground peas or lentils should be used for thickening, and add very considerably to the nutritive qualities of the soup. If meat is also given with the soup, it should be cut into small pieces before being cooked, and the soup should be constantly stirred while it is being served. It should always be served as hot as possible, because it is then warm enough to be eaten by the family when it is taken home. Any surplus stock should never be mixed with the next day's supply, but should be warmed and served separately.

The following formulæ, from the late Dr. E. Smith's work on "Practical Dietary," may prove useful to those who take an active interest in the management of soup-kitchens:—

Broth to make a hundred rations:—Meat liquor from 7 lbs. beef and 1 lb. of well-broken bones; split peas, 2¾ lbs.; Scotch barley, 3¼ lbs.; carrots, 3½ lbs.; turnips, 3½ lbs.; cabbage and other green vegetables, 7¼ lbs.; salt, pepper, and dried herbs. (Carbon 300 grains, nitrogen 12 grains, per ration.)

Soup to make a hundred rations:—Meat liquor from 7 lbs. of beef and 1 lb. bones; split peas, 13 lbs.; carrots and Swede turnips, each 6⅔ lbs.; onions, 5½ lbs.; leeks, ½ lb.; salt, pepper, and dried herbs. (Carbon 490 grains, nitrogen 36 grains, per ration.)

Potato-pie, to make a hundred rations:—Potatoes, 43¾

lbs.; meat (mutton usually), 10¾ lbs.; bones, 1¾ lbs.; dripping, 1¼ lbs.; flour, 5⅓ lbs.; onions, 3 lbs.; seasoning. (Carbon 878 grains, nitrogen 33 grains, per ration.)

The following nutritious soup was supplied at Mrs. Gladstone's soup-kitchen in Blackburn, during the Cotton Famine:—Pea-soup for a hundred rations:—Beef (meat only), 4⅓ lbs.; bones, ⅔ lb.; ham, 5 lbs.; salted pig's cheek, 4⅙ lbs.; white peas, 20 lbs.; pea meal, 2 lbs.; Swede turnips, 6⅔ lbs.; onions, ½ lb.; seasoning with pepper, curry, and salt. (Carbon 1048 grains, nitrogen 75 grains; cost, 0.94d. per ration.)

The shins of beef, necks, and heads, are the best parts for making cheap and nutritious soups, and with a proper admixture of the ingredients mentioned in the above formulæ, the soups may be varied from day to day, at a cost not exceeding one penny (about two U. S. cents) per pint.

But in purely agricultural districts, the same facilities cannot be provided for supplying large numbers; so that the laborer has generally to depend upon home resources, and these, it need hardly be said, are of a very limited description. In many parts, fuel is dear and scarce, while the cooking utensils are not only of a very primitive kind, but are so inadequate as to render good and varied cooking well-nigh impossible. Hitherto, the chief sustenance of the English agricultural laborer has been bread and cheese, with a little bacon, and if he has occasionally a small allowance of butcher's meat it is generally frizzled so hard as to be anything but palatable or digestible. First, then, he should be induced, or assisted, to provide his home with the few necessary cooking utensils, which, after all, are not dear; and he ought to be assisted in the matter of fuel. Then, his bread ought to be baked of seconds flour, or whole meal mixed with a fourth part of fine flour. If the bread is baked at home, with baking-powder, the addition of a little butter and

milk will make it all the more palatable and nutritious, and it should be kneaded into flat cakes, somewhat resembling tea-cakes. Fresh butcher's meat should be cooked chiefly in making soup or stews, and by ringing the changes on haricot beans, peas, lentils, barley, and maize, with potatoes and fresh vegetables, he could always have nourishing and palatable dishes for himself and family at a very cheap rate, and with but very little expenditure on animal food. Even a piece of bone, or a small slice of pork or bacon, will be quite sufficient to flavor a large dish of vegetable, pea, or lentil soup. The best way to cook dried haricots is to soak them first for twelve hours in cold water, then place them in a saucepan, with a little salt and water (a quart of water to half a quart of haricots), on the fire, and after boiling has commenced, to allow them to simmer until the beans are quite soft and tender, the time usually required being from two to three hours. A quart of haricots cooked in this way will make a large dish, and butter, pepper, and salt, are added; or, if the beans are afterwards fried slightly with a small slice of bacon, or a little lard and some fried onions, the dish will not only be as nutritious as meat, which will cost four times as much money, but it will be very palatable and fit for any table. As already pointed out, milk (whether skimmed or butter-milk) and good oatmeal, ought to form staple articles in the poor man's dietary. When the laborer has to eat his dinner away from home, he ought, two or three days a week at least, to take with him some soup, and warm it in the dish in which it is carried. As a rule, he will have no difficulty, if he is not near a house, in kindling a few twigs or dry pieces of turf in the fields to make a fire. When he can afford to buy sufficient butcher's meat, he might vary his dinner by using one or other of the different kinds of tinned meat.

But not only are soups of various kinds too much neglected in the homes of the poor, they are far too little appreciated at the tables of the middle and upper classes. By the latter they are generally regarded as a mere prelude to the feast, and are too often hastily swallowed merely for the sake of the glass of wine which follows; while amongst the former, as we have just seen, they are but little known. With plenty of vegetables, and a little *stock*, however, *purées* of various kinds might be made palatable and valuable dishes in every household, and become as much a feature in the national dietary of this country as they have long been in France.

In making nutritious broths and soups with a fair allowance of butcher's meat, it is advisable, when possible, to cook the vegetables separately, and the meat, if intended to be eaten with the soup, should be cut up into small pieces. In any case, the meat should be put into cold water, but should not be boiled, except when the vegetables are cooked in the same utensil, a temperature of about 150° Fahr. being quite sufficient. If the meat is plunged into hot or boiling water at the outset, the external layer of albumen is coagulated, and the juices are prevented from exuding.

In boiling meat, on the other hand, when the object is to retain as much as possible of the soluble juices in the meat, the piece ought to be of good size, and it should at once be plunged into boiling water to coagulate the outside albumen. After being kept boiling for about five minutes, the saucepan should be placed on the hob, and the temperature allowed to lower gradually; or it may be lowered by the addition of three pints of cold water to each gallon of boiling water. In boiling fish, the addition of salt makes the flesh firmer and more retentive of the flavor. In cooking green vegetables, they should first be carefully washed in cold water, but not allowed to

remain in it; then plunged into boiling water and cooked rapidly. Potatoes should be boiled in their skins, and after boiling for about five minutes, most of the water should be poured off, and then the potatoes should be steamed on the hob.

In roasting meat, the joint should be placed at first before a brisk, hot fire, with a view, as in boiling, to coagulate the outside albumen, and then the roasting may be conducted more slowly. In roasting, there is greater loss in weight than in boiling; and although the latter process may be considered slightly more economical, the flavors which give such a pleasant relish to the meat are not so freely developed. In baking meat, the loss is also greater than in boiling, and if the temperature is high and the oven close, the meat too often becomes ill-flavored and indigestible. Indeed, roasting is always to be preferred to baking, unless the meat is covered, as in a pie, and then the baking should take place slowly. Baked vegetables and fruits demand the same slow treatment.

Stewing has this advantage over dry baking, that there is no risk of charring, and the meat is rendered juicy and tender. Tough and strong-flavored meats are, perhaps, best cooked in this way, because they can be rendered very palatable and digestible by the addition of vegetables and seasoning. Frying is even worse than baking, unless very carefully done; but grilling on the gridiron is an excellent way of cooking chops, steaks, kidneys, and small dishes of fish or fowl.

Braising is a mode of cooking meat which is too much neglected. By this process the meat is just covered, and no more, with a strong liquor made from vegetable and animal juices or stock. The covered utensil, with close-fitting lid, is then exposed, with its contents, to a surrounding heat short of boiling point, and the cooking is allowed to proceed slowly. By this process, tough meats

are rendered juicy, tender, and very agreeable to the palate.

In boiling, baking, and roasting, the average losses of weight of different kinds of butcher's meat are about 23, 31, and 34 per cent. respectively.

In the cooking of salt meat, the heat should be very slowly applied and long continued.

IV. Hints on Diet.

According to the highest authorities on diet, it is not only necessary that the several food constituents should be supplied in proper amounts, but it is also requisite for healthy sustenance that certain articles belonging to the same class should be varied from day to day, otherwise the appetite cloys. Beef should alternate with mutton, for example; or variety may be secured by different modes of cooking the same article, and by a judicious use of the numerous accessories of food, such as sauces, condiments, and the like. Apart, too, from the effect which good cooking produces, it has to be pointed out that various articles differ very considerably as regards digestibility. Most people are made aware of this by painful experience; but it was also proved by the experiments of Dr. Beaumont on a patient who, as a result of a gunshot wound, had an external opening into the stomach, through which pieces of food could be introduced, and after a time withdrawn for examination. According to Dr. Beaumont's experiments, vegetable food, as a rule, requires longer time for digestion than animal food, the time varying from four hours required by boiled cabbage, to one hour required by boiled rice. Boiled potatoes and bread require three hours and a half, and boiled beans two hours and a half. As regards animal food, the order of digestibility was found to be as follows:—Tripe and pig's feet, one hour; whipped eggs,

salmon, trout, and venison steak, one hour and a half; ox liver and cod fish, two hours; boiled lamb, roast goose, and roast pig, two hours and a half; roast beef and boiled mutton, three hours; roast duck and fowl, four hours; and roast pork, five hours and a quarter.

Digestibility is materially assisted by the admixture of different articles of diet, as fat with lean meat, and butter with bread; and it is also influenced by the degree of fineness and division of the food, the amount of trituration it receives from the teeth, and the quantity which is taken at each mouthful.

Having thus far dealt with general principles, it now remains to submit a few hints of a practical nature in respect to diet, as influenced by age and employment, together with some remarks on the proper distribution of meals. And first as regards age.

Only those who have had practical experience in dispensary work, have any adequate conception of the enormous waste of infant life which results from diseases induced by the insufficient, improper, and careless feeding of infants. We have already seen, in a previous chapter, that out of every 1000 children born, 150 die before they reach the age of one year; and it is no exaggeration to say that one-third of these deaths are attributable to starvation-induced ailments; so that, in round numbers, there is an annual sacrifice of at least 50,000 infant lives.

Leaving these figures to speak for themselves, there are few who would be prepared to dispute that the proper food for a new-born infant is the mother's milk; and in order that this may be sufficiently nutritious, it is necessary that the mother herself should be in fairly good health, and be very careful as regards her diet. Cow's milk, fresh and unskimmed, should if possible be partaken of freely every day; and in respect to solid food there should be a liberal allowance of animal food, with plenty

of farinaceous food and vegetables. With the exception of a little light wine, beer, or stout—and even these might be advantageously dispensed with in many cases—the less a nursing mother takes of stimulants the better, and she should especially avoid over-indulgence in the use of tea.

As regards the infant after the first few days, it should be suckled from six to nine times daily, and, as far as possible, at regular intervals, after which a gradual reduction may be commenced, until, at weaning, the number of meals should not exceed four. The time for weaning—generally about the age of nine months—should be determined partly by the growth of the teeth, presuming, of course, that the mother's health is not suffering in the meanwhile. Whenever the first group of teeth appears, which usually happens about the sixth or seventh month, the mother may begin to diminish the number of times for suckling; and when the second group appears in the upper front gums, the supply may be cut off altogether. If the state of the mother's health prevents her from nursing her child, it may be reared on fresh cow's milk, or goat's milk, or condensed milk. When cow's milk is used, it should at first be mixed with half its bulk of pure, soft, tepid water, and sweetened with a little sugar, and a grain or two of phosphate of lime should also be supplied with it daily for the nourishment of the bony structures. Condensed milk will not require sweetening, but it should be sufficiently diluted to resemble milk-and-water. Although it is not liable to undergo the rapid changes to which cow's milk is exposed in warm weather, it is not so suitable as fresh, unskimmed milk for constant use, but it may very often be advantageously used during the summer and autumn months. I say nothing regarding wet-nursing, because physicians generally recommend that, should the mother be unfit to nurse her child herself, a trial ought first to be made, under the supervision of

the medical attendant, of artificial feeding; and the numbers of healthy infants who are reared in this way prove that, with proper care, a wet-nurse need only be employed in very exceptional instances. But great care must be exercised, especially as regards the quality of the milk, its quantity, the times of feeding, its proper preparation, and the observance of the most rigorous cleanliness. Indeed, one of the chief objections to the use of the feeding-bottle depends upon the fact that the bottle and flexible tube are not kept sufficiently clean, so that fermentive changes are set up in the milk, and the infant sickens, and very often succumbs to diarrhœa. It frequently happens, too, that the water which is used to dilute the milk is not sufficiently pure, and it is a wise precaution always to boil the water if it be derived from a surface well.

Up to six months old, then, the food of the infant should consist of milk, and, if possible, it should not be supplemented by, or mixed with, farinaceous foods, such as arrowroot, sago-flour, and the like. The quantity required, whether it be from the breast or consist of cow's milk, has been ascertained to be a quarter of a pint on the second day, two-thirds of a pint on the third day, about a whole pint on the fourth day, and this quantity is gradually increased, until, when the child is six months old, not less than two pints are wanted. Unfortunately, however, when the mother herself is under-fed, or when amongst the poorer classes the child is artificially reared, nothing like this quantity is obtained, and the feeding-bottle is charged with all sorts of messes which do not in themselves contain sufficient nutriment, and which the child cannot digest. The consequence is that the child begins to waste away, and whether diarrhœa or other form of disease sets in, the actual cause of death is gradual starvation. The reason why farinaceous foods are unsuited to a young infant is simply this, that an abundant secretion

from the salivary glands is essential to the proper digestion of foods of this description, and these glands do not begin to secrete freely until the child is about six months old. After this period, the diet may be supplemented, but at first only in a tentative way, by various articles, such as a little broth or beef-tea, tapioca, arrowroot, corn-flour, baked flour, and the like. All these and others should have their turn; but, meanwhile, the child should be carefully watched, so that any article which is found to disagree should be discontinued. And here it is necessary to allude to the dangers of weaning the child too early, not the least among which is the liability to suffer from rickets. The child may look thriving enough, but the bones are not sufficiently nourished, and the mischief is not suspected until the limbs become distorted when it begins to move about. It is in order to prevent this mischief that physicians recommend the addition of a little sugar of milk, and a grain or two of phosphate of lime, daily, to be mixed with the milk when the child is artificially fed; so long as it is well nursed at the breast, the mother's milk supplies (up to the time indicated on page 161) a sufficiency of the saline as well as the other constituents of food.

After the child is weaned, and up to the eighteenth or twentieth month, when the eye-teeth are cut, milk should still continue to form a considerable portion of the diet; and indeed, during childhood, it may be laid down as a rule that it cannot wholly be dispensed with without detriment to health. Dr. Ferguson, a factory surgeon, who has devoted a large share of attention to this subject, has ascertained, from careful measurements of numerous factory children, that, between thirteen and fourteen years, they grow nearly four times as fast on milk for breakfast and supper as on tea and coffee—a fact which proves incontestably that milk is essential to the healthy nutrition of the young. If tea or coffee is given, they should be

given sparingly and largely diluted with milk, and stimulants, except for medicinal purposes, should be prohibited altogether. For breakfast and supper, no more wholesome and nutritious dish can be given than well-cooked oatmeal porridge or gruel, with milk, and bread and butter. Animal food should only be given at the midday meal, but at first only in small quantities, and served in soups, broths, or stews, together with mashed potatoes and other vegetables, and followed by a liberal allowance of farinaceous pudding. Good cooking will make up largely for variety in diet; at the same time, it should be remembered that variety can always be secured without increase of cost, at the most homely nursery tables. Above all, there should be no stinting, because, with very rare exceptions indeed, the natural instinct of a healthy child is a safeguard against gluttony. It is only when the period of puberty is approached, or between that and the period of full growth, that over-eating is likely to be indulged in; and, as any tendencies in this direction can be readily detected, they should be as rigidly checked.

But, it may be asked, what about the crowds of very young children who have to be left behind in the impoverished home when the mothers go to work? Many, no doubt, will languish and die, but many might be saved by philanthropic effort, in the establishment of *crèches*, or nurseries, where they could be fed and tended during the day at a trifling cost. This, however, is a phase of the subject which need not be discussed, for, when sufficiency of food cannot be provided, it is mockery to talk of dietetic rules or errors. Let me rather allude to instances, common enough, in which, though sufficiency is guaranteed and expected, it is scandalously denied; and in doing so I need only refer to numbers of private boarding schools, mostly of a cheap kind, where the dietary may be characterized as a bare subsistence dietary. Although one can

appreciate the desire of parents of limited means to obtain a good education for their children at a moderate cost, they should make it a rule, before sending a child to any boarding school, to visit the school and see the pupils, and then they could readily judge by their appearance as to whether they were well fed or not. There is no doubt whatever that numbers of pupils have to suffer in after life from weakened constitutions, not to speak of more immediate ailments, induced by the scantiness of food supplied at the schools to which they have been sent; while on the other hand, there are many pupils who, though well-fed at school, ruin their digestion and become the victims of over-indulgence in after life, by gorging themselves with sweet-stuffs so long as they have pocket-money to spend. It need hardly be said that excesses in this direction should invariably be discountenanced, and treated as habits which have a low and vitiating tendency, and that undue greediness should be met with censure and reproach.

During the period of youth the diet should be as liberal as for adult age and active employment, inasmuch as bodily growth and the activity of youth have both to be provided for. It is at this stage that lads sent out into the world are apt to suffer from the neglect of a midday meal. Owing to the exigencies of business, they take little or nothing during the day, and gorge themselves when the day's work is over, so that, by-and-by, the digestion becomes spoiled for the breakfast next morning. Indeed, this is a dietetic error which prevails largely in the commercial community. Breakfast and dinner are rightly regarded as the principal meals, the one before, and the other after, the business of the day is over, but between the two luncheon should never be neglected or partaken of in a haphazard sort of way, but the lighter it is the better. If animal food is partaken of at breakfast

and dinner, it may be dispensed with at luncheon, and farinaceous foods, vegetables, and fruits should form the staple of the midday meal.

But in all walks of life, one great essential in healthy diet is regularity of meals. Among the ancients, and indeed until comparatively recent times, there were only two meals a day. This is the system which still prevails on the Continent, and with the light refreshment which is served in the morning in the form of *café-au-lait*, cocoa, or chocolate, appears to answer very well. Both *déjeûner* and dinner are substantial meals, the one being served about noon, and the other about six o'clock in the evening. In this country, however, most people indulge in three or four meals a day. For the active outdoor laborer and artisan, an early breakfast before work, a midday dinner with an interval of rest, and supper after the day's work is over, has long been proved by experience to be the most conducive to health. For the business man, a later breakfast, a midday luncheon, and a late dinner after the day's work is over, is the best arrangement. For literary men, who write more in the evening than during the day, an early dinner and a light supper will be found to be the most advantageous for steady work. Idlers, to enjoy life, if they possibly can, should dine early if they intend to spend the evening at theatres and the like; but if they accept dinner invitations freely, they should be very careful not to eat too much at the midday meal. The breakfast hour should be determined, in great measure, by the hour of rising, but, in any case, food should be partaken of before the material business of the day is commenced. Those who like to take a constitutional before breakfast, would find their appetite whetted, and their walk made all the more enjoyable, if they took a little milk, or *café-au-lait*, with bread or biscuit, before starting. Work done before breakfast is always irksome

and fatiguing, and, on that account, is very likely to be badly done; and hence, teachers or parents should never exact lessons before the first meal of the day. The last meal, whether dinner or supper, should be sufficiently late for the whole not to be absorbed before retiring to rest. If dinner is the last meal, a cup of tea or coffee, with a thin slice of bread and butter, during the course of the evening, will be found to be very refreshing; but for those who dine early, either what is known as a high tea, or a plain but substantial supper, becomes necessary. To a person in health, three meals a day ought to be quite sufficient, and the stomach ought to be educated to take enough at them to supply his bodily wants. The practice of constantly taking "something" is sure to bring on indigestion, and especially the habit, which of late years has become so fashionable, of indulging freely in the afternoon tea. If too long a period intervenes between dinner and luncheon, the latter should be moved onwards; at any rate, it is much safer to be satisfied with some fruit, an ice, or a biscuit, than that ladies should continue to "imitate their washerwomen" in lavish afternoon tea-drinking.

And now as to general rules. The three daily meals should be taken at regular hours, and these should be determined mainly by the nature of one's business or occupation. While the appetite should be satisfied, the stomach should never be filled so as to induce the feeling of uneasy repletion. The food itself should never be hastily swallowed, and solid food should be carefully masticated. No active bodily or mental exercise should be indulged in immediately after a meal. The diet best suited for the great majority of people in this country is a mixed diet, but persons leading an idle life or pursuing a sedentary occupation, should be careful not to eat too much animal food. Those who are inclined to become

too stout should take plenty of exercise, and should only partake very sparingly of potatoes, fat, sugar, and farinaceous foods generally.

As regards stimulants, they should never be given to children, and young people would be much better if they were to avoid them altogether. People who suffer from rheumatism should not drink beer, and those who have a gouty tendency should also avoid beer, rich wines, such as port or Madeira, and champagne. Finally, it may be laid down as a rule that, if health is to be enjoyed to the full, stimulants, if used at all, should be used but sparingly, and with the greatest caution.

CHAPTER V.

CLEANLINESS AND CLOTHING.

I. Cleanliness.

The important functions which are discharged by the skin ought to convince every one who knows anything about the structure of the human body, that personal cleanliness cannot be systematically neglected without risk to health. We have already seen, in a previous chapter (see Chapter II.), that the quantity of water excreted by the skin is on the average about double that given off by the lungs during the same period; and during violent exercise, for example, and in warm weather, a man may lose as much as two or three pounds in weight by means of the cutaneous perspiration alone. But in addition to water, we have carbonic acid gas and other used-up products constantly thrown off by the skin; so that it becomes a matter of the utmost importance that the eliminating functions of this organ should continue unimpaired and unimpeded. The flattened cells, or scales, of the scarf-skin are being constantly cast off, but are retained on the surface by contact with the clothing, and mingling, as they do, with the oily products of the sebaceous glands, they become glutinized as it were into a thin crust, which covers the whole of the body. This, if not periodically removed, attracts the floating dirt or dust, which is ever present in the atmosphere, and the consequence is that the balance of healthy life is disturbed by obstruction of the pores of the skin, a larger share of

work is thrown on other eliminating organs, the blood is liable to be imperfectly purified, and disorders, more especially of the skin itself, are apt to be induced.

General body cleanliness, therefore, is conducive to health, no matter what be the occupation, and the whole surface should be washed at least once a day from head to foot. Those parts of the body which are more exposed, such as the hands and face, require to be cleansed more frequently; indeed, it is a wise rule, and one that should be enforced with regard to children, that hands and face should always be washed before sitting down to a meal. But it is astonishing what a very strong objection many of the poorer classes have to the use of clean water. Their skins are filthy, their clothes are filthy, and it is needless to say they have an utter disregard for cleanliness of the dwelling and its surroundings. Hence it is that those who have made themselves acquainted with the habits and home-life of the "great unwashed," cannot help associating foul skins with moral degradation, as well as bodily ill health; and, after a little experience, are forced to the conclusion that mendicant filth and moral depravity generally go hand-in-hand.

Of course, the plea is constantly urged by this class of people that they have neither the means nor the opportunities afforded them to practise personal cleanliness—and no doubt there are difficulties in securing that degree of cleanliness which is here recommended; but the most disappointing feature in their case is that, though there may be abundance of water close at hand, they seem to have the greatest reluctance to make anything like a free use of it. They appear to love filth for filth's sake, and will contentedly submit to all the discomforts arising from plagues of parasites and other irritations of the skin rather than take the slightest trouble to rid themselves of the dirt which engenders them. Then, too, there can

be little doubt that personal uncleanliness is not only a means of engendering disease, but it becomes a breeding-ground for the propagation of those diseases which are infectious; and hence it is that elementary schools, where compulsory attendance is enforced, assist so largely in the spread of scarlatina, measles, whooping-cough, and diphtheria. The filthy condition of many of the children not only makes ready victims of themselves, but, by polluting the air and by personal contact, they impart infective particles to those who are better cared for and come from cleanly homes. All schools, therefore, should be provided with lavatories, supplied with hot and cold water, and teachers and school attendance officers ought to exert their influence in promoting body cleanliness among the pupils.

Another direction in which cleanliness could be largely promoted would be the enforcement of provisions for cleansing at all workshops and factories where offensive or dirty trades are carried on. The waste steam, or waste warm water of the factory engines could be readily utilized for properly constructed warm baths, and if the work-people were obliged to bathe and put on a change of clothes before going home, the advantages to health and comfort would soon become apparent in many ways. Many large manufacturers throughout the country have already shown an excellent example in this respect; but hitherto they have only had a tardy following.

Although public authorities have no power to enforce such provisions or regulations as have thus been briefly indicated, they can at all events insist on cleanliness of premises, and, by efficient scavengering and enforcing the removal of local nuisances, they may assist very materially in freeing the crowded populations of our large towns from the thraldom of filth. By the erection of public baths and wash-houses they may also afford facilities

which cannot otherwise be secured, and the rest must be left to the steady influence of a wider appreciation of the time-worn text, that "cleanliness is next to godliness."

But unfortunately, neglect of personal cleanliness is not confined to the poorer classes. There are numbers of well-to-do people who seldom or ever wash, and to whom the "morning tub" is an unknown auxiliary to health and comfort. And yet it takes very little time, expense, or trouble to secure daily ablution of the body of some sort. A hand-basin, a sponge, a shallow bath or flat tub, a piece of good white soap with no excess of alkali, a couple of gallons of water, and a towel, are all that are required; and the whole process need not occupy more than five minutes. Even rubbing the body first with a wet towel and afterwards very briskly with a dry one will, in most cases, keep the skin sufficiently clean during the week, and promote healthy reaction, provided a warm bath, with a good soaping, is taken at the close of the week. If such a bath cannot be procured or improvised at home, there are many places in most towns where it can be procured at very reasonable charges. Those, again, who do not use soap with the morning tub should also take a warm or Turkish bath occasionally, to preserve thorough cleanliness of the skin. To persons in health, the morning bath should be taken cold, summer and winter; but if shivering be experienced after the bath, instead of a warm comfortable glow, the temperature should be slightly raised.

Infants should always be bathed in warm water, and the transition to the use of cold should be gradual, and only tried in the summer-time. Indeed, there is no doubt that a great many children contract a strong aversion to cold water, because they have injudiciously and thoughtlessly been subjected to the cold bath at periods when they were unable to bear it. Cold is always more or less

painful, and the cleansing rites repulsive to persons of feeble circulation; and hence it is that women and young girls, unless they are strong and robust, are unable to indulge in the cold bath, even in the summer-season. The test should be, if the cold bath produces a warm glow afterwards, and no numbness of feet and hands, nor shivering, it should be persevered in, even during cold weather; if, however, the surface of the body feels chilly, and there is a tendency to shiver, the temperature ought always to be slightly raised. At the same time, it should be remembered that, by judicious training the nervous system which at first shuddered at the application of the sponge charged with moderately tepid water, will often, after a time, bear without discomfort a charge of cold water, and experience the healthy glow which follows the smart friction of a rough towel.

The best and most convenient time for taking the bath, it need hardly be said, is just after getting out of bed in the morning. A bath, too, is often found to be very refreshing after severe or prolonged exercise of any kind. In drying the skin, various kinds of towels may be used, but the effects produced by friction will be all the more beneficial if the skin can tolerate a rough towel. Many persons use flesh-gloves or hair-gloves for rubbing, and no doubt with great benefit.

Persons who are very liable to catch colds, and who are unable to indulge in the cold bath, will often find that bathing the head, neck, face, and chest with cold water will act as a very efficient means of protection. Bald-headed people especially, who have a constant dread of catching colds, should try douching the head every morning from a sponge dipped in cold water or from a small basin, as preventive. Indeed, there can be little doubt that colds would be far less prevalent than they are, if cold water was used much more freely in the

wash-hand-basin when the cold bath itself is dispensed with.

Owing to the greater shock to the system, the cold shower bath and the cold plunge bath can only be indulged in by the strong and healthy; but those who can take them, and have the opportunities of doing so, generally prefer them to the sponge bath. With warm water, either the shower or plunge bath can be rendered as suitable to the delicate as to the robust; but in all such cases, the sensations of the bather must be carefully considered. A certain amount of training is as much required to enjoy the full benefits derivable from the practice of ablution, as it is to enjoy those to be gained by healthy exercise.

As regards the time which should be spent in bathing, much will depend upon the particular kind of bath and the physical constitution of the bather. When the cold sponge bath or the cold plunge bath are used, two or three minutes at the outside will be found to be quite sufficient; but with the tepid or warm bath, the period may be prolonged to ten minutes or a quarter of an hour. The cold bath acts as a tonic, and should be taken in the morning, while the warm bath acts as a sedative, and on that account is preferable to the cold bath after excessive fatigue or exercise.

When bathing is practised in public swimming baths, in open fresh water, or in the sea, the period to be spent in the water should be regulated by the sensations of the bather, and whether he can swim or not. Injurious effects are often induced by remaining too long in the water, and by bathing at injudicious times. As swimming is one of the healthiest exercises, and is, besides, a great aid to cleanliness, to say nothing of its advantages in saving life, the young of both sexes should be taught to practise it wherever facilities are afforded. Public swim-

ming baths in large towns are already doing good work in this direction, and it is to be hoped that their numbers will steadily increase, and that year by year they will be more generally frequented.

With a view of diminishing the number of fatal accidents which annually occur during the bathing season, the Secretary to the Royal Humane Society has issued the following important instructions:—"Avoid bathing within two hours after a meal. Avoid bathing when exhausted by fatigue or from any other cause. Avoid bathing when the body is cooling after perspiration. Avoid bathing altogether in the open air if, after having been a short time in the water, there is a sense of chilliness, with numbness of the hands and feet; but bathe when the body is warm, provided no time is lost in getting into the water. Avoid chilling the body by sitting or standing undressed on the banks or in boats after having been in the water. Avoid remaining too long in the water, but leave the water immediately there is the slightest feeling of chilliness. The vigorous and strong may bathe early in the morning on an empty stomach. The young and those who are weak had better bathe two or three hours after a meal; the best time for such is from two to three hours after breakfast. Those who are subject to attacks of giddiness or faintness, and those who suffer from palpitation or other sense of discomfort at the heart, should not bathe without first consulting their medical adviser."

Bathing in the open sea is more bracing than in fresh water, and as a rule, bathers can remain longer in salt water, whether they are swimmers or not. By using such preparations as Tidman's Sea Salt, the common sponge or plunge bath may be made more invigorating; but in order to ensure thorough cleanliness of the skin, a soft water bath and soap must also be occasionally used.

Persons liable to fits of giddiness, or who have disturbed action of the heart, should avoid using a plunge bath, whether hot or cold. The other kinds of baths which are provided in bathing or hydropathic establishments, such as the douche, the needle, the spray, the electric bath, have all of them their uses, but they need not be entered upon here, because they should not be indulged in, as a rule, without medical advice. The Turkish bath often proves beneficial to those suffering from colds, rheumatism, sciatica, or gouty symptoms, and may be advantageously used by healthy persons for promoting vigorous action of the skin and ensuring thorough cleanliness. The vapor bath is also beneficial, but to most people not so enjoyable. When free action of the skin is desired, a modified vapor bath can readily be obtained in the bedroom, by placing a pail or tub containing boiling water beneath a cane-bottomed chair, and then plunging a red-hot brick into the water to keep up the generation of steam for some time. After sitting down on the chair, the body, chair and all, should be covered over with a thick blanket fastened round the neck, and the bath be continued until free action of the skin has set in. The surface of the body should then be well rubbed and dried, or first douched with tepid water, and the bather should then retire to rest. It may here be noted that a comparatively cheap apparatus is now manufactured to supply this sort of bath, and it is often found to prove very serviceable in the household, especially when colds are prevalent, or where there is a tendency to irritation of the skin.

In thus insisting on cleanliness of the skin as contributing largely to bodily health and comfort, it need hardly be said that cleanliness of the hair must also be carefully attended to. It should be kept clean by being regularly washed, combed, and brushed, and occasionally shampooed. The false hair and pads so often worn by women

become perfect receptacles for dirt and grease, and the less they are worn the better, but when they are worn they should be kept scrupulously clean.

In connection, too, with this important question of cleanliness, some few remarks ought to be made concerning the teeth. The pre-eminent part which they play in mastication, and the serious injuries to digestion which are so frequently induced by their decay, prove clearly that every care should be taken to preserve them in good working order; and yet they are perhaps as much neglected as the skin or hair. For want of rinsing out the mouth and brushing, particles of food are allowed to lodge in the small crevices between the teeth and in the inequalities between the teeth and gums, and as these speedily decompose and become acrid, they often render the breath offensive, and after a time injure the enamel, or external bony layer of the teeth. Again, the secretions of the glands of the mouth mix with these particles of food to form layers of tartar, which also aid very materially in carrying on the process of decay. The best preservative for the teeth, therefore, is cleanliness. The mouth ought to be rinsed out after every meal, and if there is any tendency to fœtor of the breath, a little Condy's Fluid in the water, or a few drops of the fluid called Sanitas, will be found to be very efficacious.* The teeth should also be well brushed once or twice daily, with water and a good tooth-powder, and the inner surfaces should receive as much attention as the outer. Care should also be taken not to take articles of food or drink into the mouth which are too hot, because there is reason to believe that they injure the enamel. There can be no doubt, too, that certain kinds of confectionery, such as acidulated drops, have an injurious effect in this respect.

* A solution of carbolic acid (5–10 drops) to the ounce of water, or a weak carbolate of soda solution may be used with advantage.—(R.)

II. Clothing.

We now pass on to the consideration of a subject which is closely allied to personal cleanliness, but which has important bearings in other respects, namely, clothing. Cleanliness of the person, as has already been pointed out, cannot be maintained without due attention to cleanliness of clothing, and this, of course, not only applies to the garments which are used for daily wear, but to bed-clothes and night-dresses. In order to insure thorough cleanliness, persons should avoid sleeping in any garment worn during the day, and bedding and bed-clothes should be thoroughly aired every morning. All clothes, after being washed, should also be dried in the open air when possible, and otherwise well aired before they are put on; indeed, clothing of every description should be frequently moved about, and should never be kept shut up in close boxes or drawers. It is almost needless to add that under-garments should be regularly changed, and outer garments, no matter of what color or texture, should always be kept clean and well brushed.

The principal use of clothing, however, is to assist in the maintenance of animal heat, by affording protection against the changes and inclemencies of the weather, and generally to add to bodily comfort. The warmth of the body is of course solely derived from food, but clothing, inasmuch as it prevents the too rapid escape of animal heat, really acts as an adjunct to food, so that in cold climates the warmer a person is clad, so much the less fuel will be required. Now, it is a natural law that when any warm substance is placed in contact with a colder one, the former parts with a portion of its heat to the latter, and this mode of transferring heat is called conduction. Any substance, too, which is warmer than the surrounding air is constantly giving off some of its heat by what is

called radiation; in other words, the heat passes off from it in all directions through the air or into space. Some substances absorb heat very readily, and part with it very slowly, and are therefore called non-conductors, while others are better adapted for reflecting than for absorbing heat. Hence clothing can be made suitable either for cold or warm climates, or for seasonal changes, by a judicious selection of materials depending partly upon texture and partly on color. Thus, in very warm weather or in hot climates, the surface of the body is best protected by a material which will readily reflect the sun's rays, and during cold weather or in a cold climate, by garments which are bad conductors. But clothing has also to be regulated according to its power of absorbing moisture, and to its non-interference with the healthy action of the skin and the free movements of all parts of the body. Its further subsidiary uses, such as the protection of certain parts from pressure, as in the wearing of boots and shoes, and its adaptability to keep out wet, are all of them points which likewise merit consideration.

Of the materials which are used, those of animal origin, such as wool, silk, hair, furs, and skins, are all of them worse conductors of heat, and therefore warmer, than materials derived from vegetable sources, such as cotton, linen, hemp, and flax. Garments worn next the skin are preferably made of wool or silk, because they absorb the moisture readily, are bad conductors of heat owing to the layers of air which they retain in their interstices, and they can be made very light and durable. Fabrics made of silk and wool are also very well adapted for under-clothing; and next in order come those made from silk and cotton or wool and cotton, then calico, and then linen. Delicate people, and those who are past the prime of life, should always wear flannel or silk next the skin, summer and winter. Those, again, who are in sound health, and

who prefer leaving off flannel under-garments during the summer, should be very careful not to leave them off too soon. Many people contract severe colds through neglect of this precaution, and women, owing to their preference for calico or linen, are much more liable to suffer in this respect than men. People who suffer from rheumatism should always wear flannel next the skin, and should sleep in flannel night-dresses, and between blankets. To workmen who are employed in hot workshops or factories, and to persons residing in warm climates, belts made of flannel are of great service, provided they are not made too thick and heavy. Indeed, thick flannels and heavy garments are always objectionable. The clothing should be as light as is compatible with warmth, otherwise it encases the body too closely, checks evaporation, and is neither cleanly nor comfortable.

As regards protection from direct solar heat, white is the most suitable color, and then gray. To wear black or dark clothing during hot summer weather is, therefore, a mistake, and persons who are in deep mourning, especially those who wear heavy folds of crape, often suffer serious depression and constant discomfort. The fashion which has lately been introduced of wearing a strip of crape on the sleeve of the coat or dress usually worn is, therefore, to be commended as much on the score of health as economy. For those who cannot afford a great variety of dresses, fabrics of a light gray color are the most suitable to wear all the year round. In warm climates, linen is specially suitable as the coolest and smoothest of all materials used for clothing, but vests of silk, or of silk and wool, should always be worn next the skin. Linen and cotton materials possess the further advantages of greater cleanliness and of imparting a cleanly appearance; and here it may be said that the wearing of dark clothes has all along been so general, just because their color conceals dirt.

During cold weather, overcoats, shawls, plaids, or cloaks should be worn out-of-doors, but they should never be thick or heavy when it is intended to take active exercise. Furs, as very bad conductors of heat, are very useful and highly prized in cold climates and for winter wear in this country. In order to keep out wet, waterproof garments of various kinds have become exceedingly popular, but as they prevent the escape of perspiration, they should always be worn loose, either as capes or cloaks. When worn as overcoats, they should be made wide and provided with ventilating gussets. Wet clothes or wet stockings should be changed whenever the house is reached; neglect of this precaution being a fruitful cause of rheumatism and chest ailments.

Bed-clothes should never be too heavy or too warm, otherwise the respiration is interfered with, the skin is made sensitive, and the body generally becomes relaxed; the night's proper rest is disturbed, and the sleeper awakes unrefreshed. Heavy cotton counterpanes are objectionable, because they weigh down the body without adding much to warmth. All coverings of the bed, except the sheets and counterpane, should be of wool. Amongst poor people, paper, whether white or brown, or even old newspapers, might be made to do excellent service in imparting additional warmth to bed-clothes, by being stitched on to a blanket or quilt. Paper is warm and light, and on that account might also be readily utilized as lining to coats or petticoats. It is needless to add that the number of blankets to be used must be varied according to the weather and season, and that spring and horse-hair mattresses are preferable in every respect to stuffy feather beds.

Great care should be taken as regards the clothing of infants and young children, because the constitution is less able to resist cold and weather changes. The absurd

delusion, which suggests that to *harden* children it is essential to expose their legs and chests to the piercing blasts of winter and the cold east winds of spring, leads to many an illness which terminates fatally. Indeed, there is no doubt that a large proportion of the deaths from lung diseases, which are so very common among young children, are due to needless exposure to cold, and to the ignorance or neglect which so generally prevails with respect to this matter. Very young children ought not to be taken out in extremely cold weather unless they are able to walk and run about, and then they should be comfortably clad. Flannel should be worn next the skin, and neither chest, arms, nor legs should be exposed. Veils are sometimes useful when the child is carried, either in the arms or in a perambulator, but they should never be too thick or warm.

Old people, as well as young children and persons who are delicate and liable to suffer from cold feet, should wear woollen stockings, summer and winter. Boots and shoes should be made to fit the feet easily, with low heels and fairly broad toes. High-heeled boots are the source of great discomfort, and interfere seriously with the free and healthy action of the muscles of the leg, while tight-fitting boots or shoes induce corns and bunions. Shoemakers, as a rule, pay far too little attention to the shape and action of the foot, and few of them know how to take the proper measurements. For example, the dimensions are generally taken when the foot is raised; whereas most of them should be taken when the foot is firmly planted on the floor, because in the act of walking it is found that the foot expands to about one-twelfth of its length, and its lateral expansion is even greater. Then, again, it is very seldom that the shape of the sole is taken, and hence it is that new boots are such a source of pain and discomfort until the elasticity of the leather permits the boot to

become moulded to the shape of the foot. For walking and in wet weather, thick-soled boots or shoes should be always worn. Goloshes are no doubt very useful, but they should be worn as little as possible, because they impede evaporation, and when worn they should cover very little of the upper part of the foot. Greasing the leather with tallow, butter, or fat, is a very effectual plan for keeping out wet. Those who suffer from tender feet should avoid wearing patent leather boots or shoes, and should frequently change their socks or stockings. Those, again, who have weak ankles, and persons who are accustomed to walk a good deal, should wear laced boots, and it need hardly be said that for a long walk or a walking tour, new boots should never be worn. At first they should be worn indoors, or during short walks out-of-doors. Lasts made of the exact shape of the foot are exceedingly useful in preventing the many discomforts and various distortions which are too often induced by badly made boots or shoes.

Making every allowance for the changes of fashion, there can be no doubt that male attire is much more natural and healthy than the clothing worn by the other sex. The tall, stiff hat, is no doubt, a mistake, because it is too heavy and impedes evaporation, and it is also a mistake to wear a belt instead of braces; but in other respects, male attire, as a rule, is easy and comfortable. But what shall we say of the tortures, discomforts, and even loss of health and impairment of physique, to which the vagaries of fashion subject the female sex? From childhood onwards perfect freedom of bodily movement is more or less interfered with. The waist is too often pinched with corsets which impede respiration, disturb the heart's action, and in extreme cases, eventually displace the more important organs of digestion. Many ladies are somehow taught to believe, or at all events act as if they believed,

that a small round waist is beautiful and attractive. But the natural waist of a handsome woman is not round, and a small waist can only be admired when it forms part of a lithe and slender figure. Indeed, a waspish waist, as it is cynically termed, may betoken a good deal of physical endurance and much personal vanity, but it says very little either for the common sense or the æsthetic sense of the lady who has thus sacrificed herself to the Moloch of a spurious fashion. The natural curve from armpit to hip of a handsome woman is rounded and graceful, but tight lacing destroys the law of balance and proportion, and makes the body as ungainly-looking as an old-fashioned hour-glass. This distortion, however,—for distortion it is,—not only offends the artistic eye, because it is ugly and unnatural, but the physician knows only too well that healthy, active life has been heedlessly sacrificed, and if he were allowed a voice in the matter he would frankly and honestly advise any one who consulted him with a view to matrimony, to beware of paying his addresses to a lady with an artificially deformed waist. The chances are that she will always be more or less invalidish, and an invalid wife cannot be expected to become the mother of healthy children, or, if they should be born healthy, she has incapacitated herself to rear them as they ought to be reared.

Ladies have only to recognize and appreciate the real beauty of the natural lines of the body, and they will soon learn to regulate their own dress and the dress of growing girls, so as to give sufficient support without causing undue constriction. The well-made corset is no doubt an improvement to the figure, but it should never be fashioned or worn so as to interfere with freedom of motion or easy carriage. Fortunately, the practice of tight-lacing is not so general now as formerly, but it is still common enough to justify a persistent protest against the folly and its

dangers. There is no doubt, too, that many would gladly leave off the practice altogether if they only could; but after a time the muscles become wasted by constriction and through want of use, so that the hugging embrace of the tight-laced corset comes to be regarded as absolutely necessary for the comfort and support of the upper part of the body.

On physiological grounds, the classic mode was incomparably superior to the modern style of dress, because the whole weight of the garments was borne by the shoulders, and not from a waist constricted by strings and bands, if not by tight-laced stays. It may be true that the style of garments worn by Greek and Roman women is not suited to our colder climate, but the closer the adaptation of modern apparel is to that style, so much the more artistic taste will be displayed, and the better will be the health enjoyed.

Dress should always be fashioned so as to obey the proportions of the body, and never to contradict the natural lines of the figure. Any dress or article of dress, therefore, which interferes with free movement and easy and graceful carriage, is objectionable. Tight dresses are objectionable, because they cramp the movement of the lower limbs; long walking dresses are objectionable, because they drag by their weight, and because the skirts often become wet and dirty; garters worn below the knee are objectionable, because they impede the free circulation of the blood, and are apt to induce varicose veins; low bodices are objectionable artistically, because they detract from the height, and from a health point of view they are still more objectionable, because many suffer seriously from such exposure during cold weather. All these are points which should be considered, no matter what be the prevailing fashion. The present close-fitting dresses, provided they are not made too tight, are to be commended,

because they are strictly in accordance with the natural lines of the body, and they are certainly calculated to display the beautiful proportions of a well-made figure. But they tempt those who are inclined to be a little too stout, to brace themselves in every way too tightly, and those who are somewhat thin and angular, to resort to padding and other strange devices. By all means let every one dress according to the fashion of the day, so far as her means or her position in life will fairly warrant her; but let her be careful never to sacrifice health and comfort to a slavish submission to any style, however fashionable that style may be. With regard to other articles of dress, such as bonnets, I will venture to say nothing, because somehow they are considered to be too sacred for criticism. Meanwhile, let me refer my lady readers to the excellent little work on the "Art of Dress," by Mrs. Haweis, where they will find the requirements of health are as fully treated as the rules of good taste are clearly indicated.

CHAPTER VI.

EXERCISE, RECREATION, AND TRAINING.

I. NATIONAL PHYSIQUE.

THE question is often asked in all seriousness—whether the British race is or is not detoriorating? and certainly, when we reflect on the many complex causes, social as well as material, which constantly and almost everywhere militate against healthy, active life, it must be confessed that, as a nation, we are exposed to this danger. At no period in the previous history of this country has the struggle for existence been more keen, nor competition in the race for wealth and position more fierce and unscrupulous. Men "make haste to be rich," and become physiological bankrupts often before they reach the age of forty-five or fifty, and so retire from business with worn-out brains and shattered constitutions. At our schools and universities, again, there is still too much of the tendency to push the head at the expense of the muscles and sinews—to make boys and lads smart and clever, rather than healthy, strong, and reliant. The fact is, that in these days, and amongst all classes, except it be among those employed in active manual labor, the wear and tear of busy life tell with the greatest severity on the nervous system; while the muscular system, and with it the evenly balanced condition of heart and lungs, gets no fair play. For example, the facilities for travelling by rail and omnibus are now so general, that walking, which in itself is one of the healthiest of exercises, is much less frequently

indulged in than it used to be. Then, again, it must be remembered, that in almost every branch of industry steam-power has taken the place of muscular energy, and lissom fingers have supplanted brawny arms. Even in the purely agricultural districts, we plough, and sow, and reap, and thresh, by steam; in short, we have so trained the physical forces of nature, and made them subservient to our will, that we have only to guide and regulate, and let them do the actual drudgery.

No doubt, all this outcome of scientific discovery has immensely increased the prosperity of the nation as regards the accumulation of wealth and all that wealth can command; but the question arises—Has it also improved the physical condition of the people? I, for one, doubt it very much; indeed, we have only to bear in mind this well-ascertained fact—that the average physique of the town population is considerably below that of the rural population, and this other fact, that during the last half-century the increase in the population of our large towns has far exceeded that which has taken place in rural and small urban districts, to feel assured that of late years the average national physique has become gradually lowered. And this is a view which is fully borne out by statistics; for, according to the extensive researches of Dr. Beddoe, the average stature of adult Englishmen of all classes in the present day is only about 5 feet 6.6 inches, and although there are no data to enable us to compare this average with the average of fifty or a hundred years ago, we can at least draw tolerably reliable inferences from the statistics obtained from the existing town and country population. Thus, to take the returns of Cumberland and Westmoreland, exclusive of Carlisle, given in Dr. Beddoe's statistics, as representative of a country population, it appears that the average height is 5 feet 8.1 inches; whereas, in the neighboring county of

Lancashire, where the native breeds used also to be undeniably tall, the average is as low, or lower, than that of England generally. But while the evidence of physical deterioration is manifest in the town-bred population, it becomes still more pronounced in the degenerate classes of the community. Thus I ascertained, when officially connected with convict prisons, that the average height of the 316 convicts received into the hard-labor prison at Portsmouth during the year 1871, was only 5 feet 5 inches; and Dr. Beddoe's statistics of the lunatics in London, Birmingham, and Nottingham, yield an average somewhat below this. In saying this much, however, I by no means would have it inferred that specimens of the strong-limbed and stout-hearted Briton are becoming rarer, but only wish to lay stress upon the fact that, in the enormous increase of population, and the rapid growth of large towns, with all their deteriorating influences at work, the weakly and under-sized have become proportionately much more numerous than they ever were before.

If, therefore, there is reason to fear that the average physique of the English race has become gradually lowered during the last half-century, there are good grounds for believing that the deterioration has reached its culminating point. Already the results of sanitary improvements in many parts of the country are beginning to declare themselves, not only in a lessened sick-rate and death-rate, but in an apparently healthier tone of public opinion. Then, too, the baneful conditions which surround many branches of industrial labor are year by year becoming less hurtful. But side by side with this improvement the need for muscular effort is also becoming less and less, so that among all classes the work and worry of life, as already stated, tell with special severity on the nervous system. Even those who are well off, and who

therefore ought to be free from the cares of this work-a-day world, run great risk of drifting into that lap-dog condition in which comfort merges into want of energy, and security into sloth. Indeed, there is scarcely a being to be less envied than the gentleman at large who has no occupation, or the lady who lolls in her carriage, and whose only aim in life is to receive visitors, return calls, and end the tedious day in the festivities of the night. For every one, rich or poor, nature imposes certain laws which cannot be transgressed with impunity, and for our present purpose, these may be summed up in the old adage that out of the twenty-four hours of each day, eight should be devoted to work, eight be passed in sleep, and eight given up to recreation of some sort. All must work, all must rest, and work and rest must be supplemented by healthy recreation. For recreation is the great relief from the wear and tear of life—the oil, as it were, which lubricates the machinery, prevents friction, and makes the wheels run more smoothly. And not only so, but it renovates the exhausted energies, and fits them to resume their work in the most appropriate way, and with the least expenditure of time. It may either consist in variety of employment, amusement, sports, pastimes, and the like, but of whatever description, its essential function, so to speak, is to provide a frequent and appropriate change of organic activity.

II. Physiological Details.

First of all, then, in order to keep the body in health it is absolutely necessary that a certain amount of exercise or *muscular* activity should be undergone daily. This has already been made clear in a previous chapter; but it may assist the reader to an intelligent understanding of the principles and practical application of the subject if I

briefly summarize some of the physiological details which were there more fully explained:—The body, it was stated, is composed of certain tissues, such as bone, muscle, and nerve; and ramifying throughout all these are the channels for conveying the blood. These tissues, again, consist of innumerable minute cells, or atoms, every one of which has its birth, lives its little day, and finally becomes broken up or disintegrated and removed as effete or dead matter by the organs of excretion—the skin, the lungs, the kidneys, and so forth. Thus there is a constant process of decay and removal going on in every tissue, and the loss of the body, and every part of the body, is in direct relation to its activity. But in order to repair this constant waste, there must also be constant renewal. This is supplied by the food in the first instance, which by the various processes of digestion becomes in part converted into blood, and from this ever-circulating, ever-changing stream, with tributaries flowing to and from every part of the body, the several tissues select or assimilate the nutriment specially suited for them, while into it they return whatever of their structure has become used up or effete.

Now, in every tissue, and especially in the muscular tissue, the disintegrating process, or process of decay, is hastened by activity, and, at the same time, by another physiological law, there is an increased flow of blood to supply the renovating material. During the period of growth, the new material is always in excess of the waste, so that there is an increase in the bulk or strength; but at whatever stage of the life of the individual, his working power, within certain limits, is in direct relation to the frequency with which the cells, or atoms composing the various tissues, are changed. Muscular activity, then, whether it be in the form of active outdoor labor or exercise, is the chief agent in promoting these wholesome

tissue-changes. For not only are the muscles themselves benefited, because they are brought into action, but by their action they increase the rapidity of the onward flow of the blood to the heart, the heart itself beats more vigorously, a larger quantity of blood is sent through the lungs, more oxygen is absorbed, a greater quantity of heat is engendered by the combination of the oxygen with the tissue-waste, and the skin and the other organs of secretion are brought into action to get rid of the superfluous heat and the products of combustion. Thus the heart, lungs, skin, and other organs of the body are brought into more active play by muscular activity; the brain and the nervous system are invigorated; the digestion is improved; and the whole machinery of the body is kept in efficient working order. On the other hand, through want of sufficient bodily exercise, the constituents of the food which pass into the blood are not sufficiently oxidized, effete products accumulate; the muscles become flabby or fat; the digestion is disordered; the nervous system becomes enfeebled; the function of secretion is impaired; and ill health or disease ensues. Indeed, it may be laid down as a rule that, other things being equal, those who take a sufficient amount of exercise in the open air or are employed in active outdoor labor, will enjoy the best health and live the longest; and this is borne out by the statistics of the Registrar-General, which clearly prove that gamekeepers, farmers, and agricultural laborers are among the healthiest classes of the community.

Seeing, then, that general muscular exercise is not only conducive but essential to the maintenance of sound health, it becomes a very important question to determine what amount is necessary to keep the intricate machinery of the body in good working order.

It would take up too much space to enter here into the

physics or physiology of this question, but it will suffice to say that extended experience and numerous experiments both agree in laying it down as a rule that the amount of exercise required by a man of average height and weight is equivalent to a daily walk of eight or nine miles along a level road. This rule, of course, only applies to a man in the prime of life—for growing lads or women, who, by the way, are rated as physically equal to lads of sixteen, the amount of exercise required would be somewhat less. But while growing lads, when under favorable circumstances, as a rule, take more than their allotted amount of exercise, it is notorious that the majority of men, if we exclude those employed at active outdoor labor, take nothing like that amount, and women take less still; and this neglect of exercise is a most fruitful source of ill health among both sexes, but especially among the latter. Of course, the ordinary avocations of life may reduce the eight or nine miles' walk very considerably, or, in respect to some outdoor employments, it may be dispensed with altogether; but to those whose employment is mainly sedentary, or inactive, this amount of exercise, in some shape or form, is indispensably necessary. It may be varied in many ways, and, as we shall presently see, the more ways the better; but for the most part it should always be taken in the open air.

We now pass on to the consideration of another very important question, which shows further that healthy recreation or exercise depends on the fact that a frequent change of organic activity is actually necessary. We have already seen that when a tissue or organ is doing its work, it is expending energy which it has previously obtained from the food which it has assimilated. Now, if the supply of energy due to nutrition is equal to the outlay expended in work, the working capacity of the

13

organ or tissue will remain stationary; but if the work done is in excess of the nutrition supplied, the tissue or organ will speedily become exhausted and unfitted for further work until it has again assimilated its proper amount of nutriment. We thus see that every organ and tissue of the body requires periods of rest to alternate with periods of activity; indeed, as Dr. Poore has well put it, "Our whole life consists in a series of vibrations, periods of tension alternating with periods of relaxation; and though the rapidity of these vibrations varies immensely, they are recognizable in all our acts, be they voluntary or involuntary." Even the heart, which is ceaselessly beating without our control, has its period of absolute repose, and its period of functional exercise, to alternate with its period of active labor—in this respect teaching us a lesson which we should apply to the habits of our daily life. But in the case of the heart and other organs depending upon involuntary nervous stimulus, the activity is tolerably constant, because the outlay of energy is kept constantly balanced by the income. In the case, however, of the voluntary nerves and muscles, the expenditure of energy far exceeds their income during the period of activity, and hence they have to draw upon the stores of energy which they have accumulated during their previous periods of repose. So far as certain groups of muscles, nerves, or even parts of the brain are concerned, these periods of repose may consist either of periods of local sleep, or they may take place during general sleep. Thus a part of the body may become exhausted, and require repose, or local sleep, when the whole body is not sufficiently exhausted to require general sleep; and the value of suitable recreation and exercise depends upon the fact that this local exhaustion can be restored by allowing that part to rest while the sphere of activity is transferred to some other part.

Having so far entered into physiological details, let us now proceed to consider some of the bearings of their application. It has already been made evident that activity is necessary for every part of the body, and that the period of activity must be followed by a period of repose, or local sleep, and what is true of every part is true of the whole system—sleep being only a period of general repose, during which the muscles and nerves under our control are refreshed and built up by the process of nutrition. But inasmuch as work, which is necessary for all, is infinitely varied, and taxes some parts of the nervous and muscular systems without calling other parts into action, it becomes clear that recreation or exercise must be infinitely varied too. Hence it is that a student who has wearied his brain over a mathematical problem, finds a relaxation, and becomes refreshed, by devoting his attention to the study of a classical author; that the historian finds recreation in the pursuit of science; that the hard thinker finds relief in the fields of light literature; and so on. These are examples of mental work and mental recreation, but work of whatever description which tells almost exclusively on the nervous system must be relieved, as has already been shown, by due attention to the exercise of the muscular system. Indeed, to professional men, men of business, and all those whose pursuits in life are more or less sedentary, plenty of outdoor exercise is almost a *sine quâ non* of sound and vigorous health.

On the other hand, the kind of recreation to be recommended as necessary for those who are engaged in active outdoor employment should obviously not be of the athletic kind, although sports and pastimes may be freely indulged in by all. Naturally, the kind of physical recreation which will be of value to the workman will depend in great measure upon his occupation. If, for

example, the muscles of the arm are mostly brought into play, as in the case of the bricklayer, carpenter, and blacksmith, the exercise to be indulged in should be such as will sustain the healthy activity of the muscles of the lower limbs. As a rule, however, this is sufficiently provided for by the walking to and fro incidental to the employment, so that it may be said that the kind of recreation most suitable for all who earn their living by "the sweat of the brow" should be mental and emotional rather than muscular. So far as the physiology of recreation is concerned, the points to be borne in mind with respect to each individual are these:—(1) That general muscular activity is necessary for all; (2) that if any sets of muscles are kept vigorous by specialty of labor, the others should be kept in healthy activity by suitable exercise; and (3) that those whose work is chiefly mental may obtain healthy recreation by directing the mind into other channels. For just as certain muscles are almost exclusively employed in certain kinds of bodily labor, so certain parts of the brain are more severely taxed than others in certain kinds of mental work, and it is by reason of this localization of brain-function, so to speak, that we can understand how the man of science and the historian may find recreation from each other's pursuits, and how the hard-working student feels his jaded mind refreshed by varying his subject of study.

III. National Aspects of the Question.

But whatever be the kind of recreation indulged in, it is of the highest importance that the feelings should invariably be pleasurable. There is an old saying that a hearty laugh does one good, and there can be little doubt that the ancient custom of exciting laughter at table by jesters, or buffoons, was an excellent aid to the digestion of the heavy meals of by-gone days. Be this as it may,

there can be no question that a prolonged flow of happy feelings does more to brace up the system for work and recreate the mental energies than any other influence operating for the same length of time. Hence the recreative value of pleasant society, whether obtained in a cheerful home, in a club, at the theatre, or any other innocent place of amusement. We have been accused, as a nation, of amusing ourselves sadly; and there is perhaps some foundation for the accusation, inasmuch as the humane tendencies of the age have banished all the rougher sports of our ancestors, without supplying us with appropriate outlets for the hereditary instincts of action, frolic, and passion, which, for good or evil, still linger in most of us. Reading-rooms, mechanics' institutes, and museums no doubt contribute largely as aids to recreation, but we want all these and something more. For the masses in our large towns we want places of resort and amusement, which will supplant to a large extent the public-house and the licensed music-hall; and it is an augury of happier times that men of eminence and large philanthropic views are exerting themselves in establishing coffee-houses and temperance music-halls, which will afford opportunities of social intercourse and amusement, and avoid the dangers of drink. The vast benefits to be derived from public parks are so obvious that they require no comment, except that they should be always utilized as free open breathing spaces, where lungs and limbs can be exercised without stinting or restraint. Let them be adorned with trees and decorated with flower-beds by all means, but not to such an extent as will curtail the necessary space for cricket, foot-ball, and other healthy sports. And here it may be noted that there is a steadily growing conviction among many of the leading men of the day, who cannot be accused of irreligion, that the intolerance to innocent Sunday recreation, which has hitherto prevailed, has

without doubt a deteriorating influence on national health, and therefore exerts a vitiating influence on national morals. They argue that working men who go to church will continue to go to church, and that if the clergy would only consent to the opening of museums, art galleries, and to the playing of bands in the public parks on the Sunday afternoon, they would wean over large numbers to attend church in the forenoon or evening, who at present never go to church at all. To the teeming multitudes in our large towns, Sunday is the only day in which they are freed from the turmoil of stifling work, and, apart from religious observances, the question is whether it would not be better to help them to healthier life by enticing them to public parks, museums, art galleries, and the like, than to leave them to drift to public-houses whenever the doors are open.

This, however, is a phase of the subject which it would be out of place to discuss here. The great problem is how to multiply the means of healthy recreation, and make them more accessible to the great masses of the people. It is not enough to lessen the hours of labor, and make statutory holidays, unless at the same time efforts are earnestly and persistently made to ensure that the holidays of the many are not spent in lawless drinking bouts, and that the spare hours are not worse than wasted. Workingmen's institutes, clubs, reading rooms, *cafés*, are all of them destined to contribute largely to prevent the misuse of leisure hours; but we want gymnasia as well as reading-rooms, playgrounds everywhere for the children, people's parks in plenty for our large towns, and village greens for our villagers; and along with all these, we want some revival of those active outdoor amusements and games which made our forefathers such an active and sturdy race. It is true that modern civilization has not banished these altogether, but it has done much to dis-

courage them, and has in this way contributed, and in no small degree, to that downward tendency of the national physique which has already been referred to.

There is, however, one movement which is steadily gaining in popularity, and which has already done so much good service in the cause of physical recreation that it claims especial notice, and that is, volunteering. Only those who have been volunteers themselves can appreciate the great and lasting benefit which the drill and exercise incidental to the service confer, and, speaking as a volunteer, I would strongly advise every able-bodied youth to enroll himself in some volunteer corps, for the sake of the advantages to be gained from the discipline and training, if for no other reason. We have only to take a glance at the national life of those grand old Greeks to be convinced of the vast importance of physical education when properly understood and carried out. All their national games—Olympic, Pythian, Numæan, and Isthmian—were specially directed to develop the highest possible attainments in individual culture, courage, and skill; and they succeeded so well that in no race, and at no period of the world's history, has there ever been witnessed so marvellous a development of physical perfection amongst men, nor have there ever been such glorious legacies bequeathed to futurity in the domains of philosophy, literature, and art.

Having said so much with respect to the national aspects of the question, let us now proceed to consider the kind of recreation and exercise suitable for different periods of life and for each sex.

IV. Exercise during Childhood.

"A child in health," says Sir W. Jenner, "delights in movements of every kind. It joys to exercise every muscle. Strip a child of a few months old, and see how

it throws its limbs in every direction; it will raise its head from the place in which it lies, coil itself round, and, grasping a foot with both hands, thrust it into its mouth as far as possible, as though the great object of its existence at that moment was to turn itself inside out." Now, these grotesque movements constitute the natural exercise of the child, and parents and nurses should be particularly careful not to impede the free motion of the limbs, either by tight clothing, or by strapping the child in a narrow cradle or crib, in which it can scarcely turn. A fixed cot is always preferable to a bassinet with a rocking or swinging motion, because a child, when once habituated to the rocking motion, will seldom fall asleep or remain quiet unless the rocking is continued. So soon as the child begins to crawl on all fours, it should be allowed to do so freely; but when it commences to walk, it should be carefully watched, and not encouraged to stand too much on its legs, because at this period the weight of the upper half of the body is proportionately much greater than it afterwards becomes, and the strain thrown on the lower limbs is at first excessive. It is owing to carelessness in this respect that many children become bandy-legged and crippled for life, whereas a little more watchful care would have prevented all the mischief. When a child reaches the age of three years, exercise of a more or less systematic kind may be commenced. The perambulator should now be dispensed with, and the child encouraged to run about after a ball, and the like, and, later on, to trundle a hoop. Indeed, it should always be remembered that most children will play as they ought to play if they are left untrammelled by artificial restraints. Indoors, a rocking-horse, without stirrups, and not too broad a saddle, will afford ample scope for the exercise of the muscles generally, and especially those of the back. The nursery itself should be as light and airy

as possible, and the floor uncarpeted. In the case of the lower classes, the establishment of *crèches,* or public nurseries, deserves every encouragement.

And now we come to consider the physical education of school life. It need hardly be said that as every school ought to be a nursery of health as well as of intelligence, it is highly essential that the sanitary condition of the school and its surroundings should, in all respects, be satisfactory. The desks and benches should be constructed and arranged with a view to remove discomfort, support the back and feet, prevent any straining of the eyes when the pupil is writing or drawing, and do away with the risks of weakening and distorting the spines of pupils, especially in girls' schools. In the new Board Schools, desks and benches of this description are now in general use, and it is to be hoped that the old-fashioned long forms, without backs or foot-boards, will soon be banished from every school throughout the country. In infant schools, again, there should always be plenty of floor space, so that the children can march, sit, or be exercised without restraint.

With respect to that most indispensable adjunct of every school, the playground, it may be said generally that it is often most limited where it is most required. In large towns land is so dear, that in London, for example, buildings of two or three stories have become essential, with, in some cases, playgrounds on the roof, or under arches, although in every instance some provision has been made for the recreation and drill of the children. But breathing space and room for play are of such vital importance to the healthy growth of young children, that any conditions which tend to cramp them into too limited dimensions must be regarded as crippling very much the influences for good which public elementary schools possess in other respects. When ample space for real play

cannot be obtained, much benefit may be derived from adopting other forms of active exercise, which need not require more space than the floor of the school-room affords. The simplest forms of drill training, if well conducted, so as to procure precision and thereby give zest to the various movements and evolutions which may be carried out, will do wonders in helping to strengthen and straighten the weak limbs of growing children. A kind of rhythmic chant introduced now and then, as an accompaniment, will also help to expand the lungs, and at the same time relieve monotony, by creating a certain amount of pleasurable excitement. All this, of course, applies more especially to infant schools; but even for boys, and for that matter, girls too, in the more advanced classes, drill training is equally essential, and should form a part of regular instruction and school discipline.

V. Exercise for Boys.

At our large public schools and good private schools, the playground becomes as important a feature as the class-room, because schoolmasters, of all men, know best that, unless boys have ample time and space for play, the energy of body and mind fails, and the school work suffers. For the most part the exercises indulged in are purely recreative, and are left pretty much to the inclinations and regulations of the boys themselves. The great danger to be guarded against is, allowing the weak and delicate to engage indiscriminately in games for which they are altogether unequal. Thus, while cricket may be freely indulged in by almost every boy so soon as he is able to wield a bat, he ought not to be permitted to take part in foot-ball matches with lads much older than himself, nor unless he is physically strong. There can be little doubt, too, that a good many lads suffer from the excessive strain thrown upon them by indulging too freely

in athletic sports, such as running and jumping. Up to the age of seventeen, activity of growth proceeds so rapidly in most lads that severe competitive sports of any kind should be discouraged, not only on account of the risks attending the struggle of the day, but also on account of the strain thrown upon them by the necessary training. Till then, the ordinary school games will afford sufficient healthy recreation, and it is only when a lad leaves school for the university, or to start in life, that he should think of taking part in any of those contests which tax physical strength and endurance to the utmost.

But in addition to the recreation afforded by cricket, swimming, foot-ball, tennis, hockey, fives, rackets, and so on, there ought to be a regular system of educational exercise carried out under proper supervision, and carefully regulated to suit the requirements and capacities of the various groups of pupils. It is on this account that drill exercise of even the most rudimentary kind is of such value in developing and strengthening the weak frames of city children; but at all schools, even where there is plenty of playground space for the usual games, the advantages to be gained from a regular and progressive course of bodily training cannot be over-estimated. Nor need the requisite apparatus be of a complicated or expensive kind. If, for example, a corner of the playground were covered over, and had fixed in it two or three sets of what are called the horizontal bar, the parallel bars, and the wooden horse, any well-attended school would be provided with a gymnasium, which, under proper tuition, would supply all the means requisite for healthy bodily training. Of course, for our large public schools, a gymnasium, properly fitted up with every appliance, is a great desideratum, and, indeed, is usually provided; but for the great majority of schools, public or private, the limited amount of apparatus which I have just mentioned, sup-

plemented, it may be, by the swing and trapeze, would be amply sufficient. But to be of real value, all exercises of the kind, as already stated, should form part of the regular course of instruction, and ought to be carried out either under the supervision of a drill-master or of the teacher himself, provided, of course, that he takes the trouble to master the subject.

And here it may be remarked in passing that it would be greatly to the advantage of the pupil, and to the discipline of the school generally, if punishment drill of some sort were substituted for the cruel impositions which have become so generally resorted to of recent years, and which very often result in a distaste for reading or study of any kind. Few boys would care to lose play-hours or half-holidays in this fashion; so that, while there can be no doubt that punishment drill could be made sufficiently repugnant, it would possess the advantage of affording plenty of exercise in the open air or under cover. In writing an imposition, the nervous energies are not only dissipated in a wholly useless manner, but in imprisoning the culprit in a dull room at the same time, his bodily energies become exhausted too, and he is thus doubly unfitted for work. Indeed, there can be no question that corporal punishment, when not unfairly administered, is in every respect preferable to the tedious, fatiguing, and unhealthy systems which the vapid sentimentalism of the day has brought into such general use.

VI. Exercise for Girls.

Having said so much with respect to the physical recreation of boys, let us now consider the subject very briefly as applied to girls. Up to the age of eight or ten years, I do not see that there need be any very material difference in the training of both sexes. Plenty of playground space, simple drill exercise, rope-skipping, swings,

and so on, should be provided and encouraged as much as possible. It is after this period that the great mistakes which are made in the physical education of girls are likely to occur, and do still occur, notwithstanding all which has been said and written on the subject. At most ladies' schools, the humdrum daily walk, and that only when the weather is fine, is almost the sole form of exercise in which the girls are allowed to indulge. It is quite true that nowadays we hear a good deal about calisthenics; but it is very much to be feared that, like a good many other items in the showy prospectuses of ladies' schools, they do not amount to very much in the long run. Unfortunately, too, the tyranny of dress and fashion interferes to a very serious extent with many forms of active exercise, which, while they are seemly enough in themselves, would make growing girls more graceful, and certainly much more vigorous and healthy than many of them are.

It should always be remembered, in the case of girls as well as boys, that school life is the time when the organism most requires the strengthening and purifying influences of bodily recreation, and hence every reasonable scope should be given for the healthy flow of natural joyousness. But as a matter of fact, the school-girl of the present day is taught to curb her natural spirits, to regard innocent amusements and any kind of romping as unladylike, to indulge in no exercise except that which is allowed by a prison-like routine, and to accept the dull monotony of her school life as an absolutely essential training for the part which by-and-by she will be expected to play in the conventionalities of every-day life. All her physical energies are sacrificed to the bondage of a genteel deportment, and is it to be wondered at that, whatever may be the long list of her showy accomplishments when she leaves school, she returns home with an enervated con-

stitution, which makes her a ready victim to all sorts of nervous disorders? In order to become healthy women, and, above all, healthy wives and mothers, it cannot be too strongly insisted on that girls' schools should be utilized as places intended for healthy recreation and bodily culture, as well as for sound education and mental culture; and surely there might be large concessions made in this respect, without any risk of sacrificing either to refinement or good breeding. No one would care to see young ladies emulate their brothers in the cricket-field; but there are many games in which they could indulge, and which would prove equally beneficial, such as lawn-tennis, Badminton, fives, rackets, battledore and shuttlecock, and other games of the playground. The misfortune is, however, that in large towns the playground space either does not exist at all, or is so largely curtailed that it is practically useless, and to meet this difficulty, it has been suggested that schools might club together to provide a joint playground —care, of course, being taken that the social position of the pupils is duly considered. The same joint efforts might also be made, under a responsible committee, to provide a suitable establishment where swimming, rowing, and a few special gymnastic exercises might be taught. Swimming and rowing are both of them excellent exercises for girls, and so is riding, when the family resources are sufficient to afford it. If parents and guardians made it a duty to inquire personally into the opportunities afforded for healthy recreation, and indeed into the general sanitary condition of schools, before sending their charges to them, there would no doubt be a speedy and general improvement in this direction; but at present the teachers exert all their efforts in taxing their pupils' brains with a medley of subjects which they soon forget, and often with accomplishments, as they are called, for which they have neither capacity nor liking, while physical recreation is grossly neglected.

But apart from outdoor games, active indoor amusements ought to be encouraged, and one of the healthiest of these is dancing. To quote the eloquent words of the late Canon Kingsley, who wrote so much and spoke so well on this subject of physical education:—"If the promoters of higher education for women will compel girls to any training analogous to our public school games; if, for instance, they will insist on that most natural and wholesome of all exercises, dancing, in order to develop the lower half of the body; on singing, to expand the lungs and regulate the breath; and on some games—ball or what not—which will ensure that raised chest, upright carriage, and general strength of the upper torso, without which full oxygenation of the blood, and therefore general health, is impossible; if they will steadily forbid tight stays, high heels, and all which interferes with free growth and free motion; if they will consider carefully all which has been written by Mr. Chadwick and others, and accept the certain physical law that, in order to renovate the brain day by day, the growing creature must have plenty of fresh air and play, and that the child who learns for four hours will learn more, and learn it more easily, than the child who learns for the whole eight hours; if, in short, they will teach girls not merely to understand the Greek tongue, but to copy somewhat of the Greek physical training, of that 'music and gymnastic' which helped to make the cleverest of the Old World the ablest race likewise; then they will earn the gratitude of the patriot and the physiologist, by doing their best to stay the downward tendencies of the physique, and therefore ultimately of the *morale*, in the coming generation of English women."

VII. Exercise for Women.

As already stated, then, there is not the smallest room for doubt that the delicate health from which numbers

of grown-up girls suffer is, in large measure, owing to the utter want of any adequate amount of exercise during the period of their school life; and the aversion to activity of any kind—except perhaps it be dancing—which is thus engendered, becomes habitual to them, so that in after years they become more or less invalidish, and are seldom out of the doctor's hands. Look, for example, at the lazy, listless existence which the fashionable lady in town leads, and contrast it with the active, vigorous life which brings roses to the cheeks, roundness to the limbs, and gracefulness of carriage to the country girl, who feels that plenty of outdoor exercise is a *sine quâ non* of her existence. Is it to be wondered at that the former, addicted to late hours in crowded rooms, and who takes no outdoor exercise, save what she obtains by lolling in her carriage, should look languid and delicate, and soon begin to complain of headaches, lassitude, feeble circulation, and often of ailments worse than these? This habitual violation of one of the best known of the laws of health, the neglect of taking a sufficient amount of bodily exercise, is one of the most fruitful sources of disease and early death, and no class suffers more than the ladies of the upper and middle ranks of society. Hence their eagerness for the close of the season, so that they may rush to the fresh air of the country, forgetting all the while that, by living a little more in accordance with the laws of health, even town life may be made enjoyable apart from its gaieties and distractions. If ladies cannot ride, or have not the opportunity of riding, they can at least take a daily walk, with some pleasant companion, either in the park or when shopping. Then there are lawn-tennis, as already said, skating, boating, and the like, for the young and active, and, above all, there is plenty of dancing; but, unfortunately, the late hours more than counterbalance the good which this would otherwise confer. All these re-

commendations apply more especially to the young or middle-aged, but even ladies who are beginning to advance in years cannot afford to neglect the few miles' daily walk if they wish to keep in good health. I know a lady, close on sixty, who on the average walks six miles daily for the sake of her health, and as a consequence she seldom suffers from an ache or pain of any kind, and is one of the healthiest of her sex. Of course, a great many urge that it is physically impossible for them to take anything like that amount of exercise; but if they would only make a beginning and persevere, it is astonishing how comparatively easy it would afterwards become, and what a surprising amount of benefit it would confer.

Among the working-classes, the labor entailed in managing household work, or different kinds of employment, assists greatly in preventing much of the illness which is brought on by the inactivity of the lives led by those in better circumstances. Household servants in our large towns should not be grudged their "Sunday out," on account of the benefits which the fresh air and a walk in the park confers, not to speak of other opportunities for other kinds of healthy recreation. Indeed, what has been already said with respect to the recreation of the working-classes generally, applies in great measure to the other sex, inasmuch as they share to a large extent in the recreation of their male friends and relatives. Public parks, innocent places of amusement, penny readings, window gardening, mothers' meetings, book clubs, all contribute to relieve the pressure of the work and worry of every-day life. Then, too, it should be noted that in the interests of the numbers of friendless shop-girls and dressmakers who are to be met with in all our large towns, the movement which is now on foot of establishing friendly lodges, or clubs, under proper management, is one deserving of every encouragement and support.

VIII. Exercise for Men.

Reverting now to the recreation suitable for male adult life, it has already been pointed out that those whose occupation is for the most part indoors and sedentary, ought to take an amount of outdoor exercise equivalent at least to a daily walk of eight or nine miles. The clerk who has to sit for so many hours daily at his desk, should start early enough to enable him to take a brisk walk before he enters the office, and should take another after the work of the day is over. Of course, if he is fond of bicycling, cricket, foot-ball, and the like, so much the better. Let him indulge in these active pursuits as much as he can, and he will be able to dispense with long walks, which are apt to prove somewhat dull and monotonous. But when a man approaches the period of middle age, he becomes incapacitated for any active sports which are apt to throw a sudden or severe strain upon the heart and large arteries, and he ought therefore to take to exercises of a less violent description, such as riding, hunting, fishing, shooting, golf, bowls, and the like; or, if he cannot afford, or has not the opportunity to indulge in these, he must apply himself all the more assiduously to the daily walk. For it cannot be too strongly insisted on that at no period of life is outdoor exercise more essential than it is between the ages of forty and fifty, because it is generally at this period that the worry and work of life begin to tell on the vital organs. Dyspeptic symptoms begin to assert themselves; derangements of the liver, weariness, headache, uneasy and disturbed sleep, palpitation, floating specks on the field of vision, are all of them clear indications that the health is failing—it may be from worry and overwork, or it may be from eating and drinking more than can be assimilated by the system, but in the great majority of cases it is because physical exercise has for

some considerable time been grossly neglected as well. Look how even an occasional day's hunting or shooting serves to drive away the cobwebs from the brain, and remove some of the uncomfortable symptoms just alluded to, in the case of many a man who has been sticking too closely to business, and there will be no disputing the curative as well as preventive value of active exercise in the open air.

But it is urged by many that it is all very well to recommend exercise:—what if they have not the time to spare? The answer to this is plain;—find the time. It is no great hardship to get up a little earlier in the morning, and in the evening a portion of the leisure which is spent at the club, or is devoted to whist, would be much more advantageously expended in taking some kind of outdoor exercise. But, whatever the form of exercise, there should be no lack of heartiness and zest; a profound belief that it is essential to sound health will make it all the more enjoyable in the long run. The sense of weariness and fatigue, which is so often complained of after the labors of the day as a bar to exercise, will be found to be dispelled by it, because in most cases it is purely subjective, and has been induced through sheer neglect of muscular activity. Then, too, it should be borne in mind that if the premonitory symptoms already referred to are disregarded, the chances are that serious disease will sooner or later set in, either in the form of gout, fatty heart, or grave disorders of other organs.

Unfortunately, however, there are numbers who pay no heed to these warnings, so that long before the annual holiday comes round, they are utterly jaded and worn out, and when they do get their holiday, they are apt to rush from one extreme to the other. They take either to walking tours or long tramps on the moors, when a moderate walk is as much as they can accomplish without subjecting

themselves to extra fatigue, and the consequence is that they run the risk of becoming completely knocked up at the very outset. Having neglected to take a sufficient amount of exercise for some time back, there is not only a want of concordant action between the heart and blood-vessels when an extra strain is thrown upon them, but the muscles are likewise out of condition, and therefore easily fatigued. Men, too, become crippled for a time from blisters or abrasions on the feet, because walking had not been sufficiently practised beforehand to harden them, or because the holiday is commenced with thin-soled or badly fitting boots. A reasonable amount of preliminary training, and better attention to details of the outfit, would prevent all this disappointment and mischief, and the holiday which is wisely and judiciously utilized will be found to confer more benefit from the exercise which is taken than from the change of air, which is usually credited with almost all the advantages gained. On the other hand, it should be remembered that the man who keeps up his *quantum* of exercise daily, keeps himself in sound health and fair training as well, and hence he can undertake tourist feats or face the moors, not only without undue fatigue, but with enjoyment; whereas the one who takes his exercise by annual instalments, as it were, becomes easily overmatched, and cannot understand why, with his years still light upon him, he is not so good a man as he used to be.

IX. Exercise in Old Age.

When old age creeps on, the limbs become stiff, and certain changes are slowly taking place in the heart and blood-vessels, which render vigorous exercise inadvisable even when it can be undertaken. The waning energies of the body have to be carefully husbanded, and exercise should never be indulged in to such an extent as to induce

extra fatigue. But though both the necessity and desire for physical exercise are on the wane, it should still be practised as regularly as individual conditions and circumstances will permit. So long as walking can be indulged in, it is wise to keep it up, and if horse exercise can be taken, an occasional ride will be of the greatest benefit. As regards other suitable kinds of exercise, there are few to select from, but many can enjoy a game at bowls, golf, or a day's fishing, even when verging on the "three-score years and ten." After the period of decrepitude has set in, every endeavor should be made not to keep too much indoors. When the weather is fine, a drive in the carriage, or a turn in a bath-chair, will help to refresh the failing energies, and even the change from one room to another will often prevent the patient from becoming bedridden as soon as he otherwise would.

X. Training.

The object of training, in its narrowest sense, is to get the body into such a condition and maintain it in that condition, that its average working powers can be called into action at any time without incurring risk or detriment to health. But in order to be able to exhibit the maximum amount of physical power and endurance of which the body is capable, a man must submit to a certain *régime* more or less complicated. His diet must be liberal, carefully regulated, and contain little or no alcohol; his daily exercise must be systematic and progressive, his hours must be regular, and he must avoid all excess. The results are—that the breathing power is gradually increased, a concordant action is established between the heart and blood-vessels, so that there is no blockage when the rapidity of the heart's action is accelerated during exercise; the blood passes more freely through the lungs, and is more freely oxygenated; the organs of secretion get

rid of the waste material more quickly and efficiently; and the vigor and power of the muscular and nervous systems attain their maximum development. These are the results which ought to be aimed at, but unfortunately, the tendency to specialization in athletics tempts many men to devote too much attention to one kind of exercise, and so to develop some particular parts of the system to the neglect of others. No doubt this evil is to some extent unavoidable, but for sound training the exercise should be as varied as possible. This will at once become clear when it is remembered what parts of the body are brought more prominently into action by particular kinds of exercise. For example, in walking, running, leaping, and riding, the muscles of the legs and trunk are chiefly exercised; at tennis, rackets, cricket, fives, and rowing, the muscles of the legs and arms are chiefly employed; while in swimming, fencing, boxing, and climbing, all the muscles of the body are brought into nearly equal action.

But in addition to muscular strength or endurance, the other great object aimed at in training is breathing power. This is best acquired by running, or it may be acquired in rowing with a quick stroke, but for the sake of variety of exercise it is always recommended that those who intend to compete in boat-races should indulge in occasional runs during the morning walk, which may be lengthened as the breathing power increases. Men who are inclined to be a little too stout, very often take to running in flannels, in order to get rid of the superfluous fat; but this plan cannot be recommended on physiological grounds, because the breathing power is embarrassed by too thick flannels, and consequently the carbonic acid is not so freely given off as the waste of tissue during and after severe exercise requires. If the action of the skin is sluggish, it is a much better plan to take a Turkish bath to begin with, and afterwards, when the morning tub is taken, to rub well

with a rough towel. During training, the morning tub is generally regarded as indispensable, and should be taken immediately after getting out of bed. In very cold weather, and in the case of those who do not experience the healthy glow of the skin afterwards, it should be taken tepid or with the chill off. As a rule, the cold bath should be dispensed with at any other time of the day, because after severe exercise the bodily powers are depressed, and the body warmth ought not to be largely drawn upon; a rub down with a wet sponge, or a cold douche, when it can be conveniently obtained, will be quite sufficient, and this should be followed by a vigorous towelling. Very often a warm bath before going to bed will be found to be very soothing, especially if there are symptoms of cramp or muscular tremor; and if soap is freely used at the same time, it keeps the pores open and aids the healthy action of the skin.

It need hardly be said that one of the common results of training is excessive muscular fatigue, or local exhaustion, and this is generally accompanied by twitching of the muscles or cramp. Men in training should therefore be very careful to avoid persevering to such an extent as to induce these symptoms, otherwise they are likely to succumb from over-training, or "training off," as it is called. Whenever a man becomes "stale," that is, when he begins to lose flesh when in good condition, dislikes his food, has no zest for exercise, and suffers from disturbed sleep, he ought at once to consult a physician, because these symptoms may be due to causes independent of the training itself, and which mere rest for a day or two may therefore fail to remove. Then, too, it is always wise to take medical advice when boils appear, as frequently happens, or any other derangement of the system which incapacitates for severe exercise.

Another condition which should be carefully watched

during training is the action of the lungs and heart. If the pulse rises too high or becomes irregular, or if palpitation, breathlessness, or deep sighing is induced, the training should at once be left off, otherwise there is risk of a serious breakdown. And here it may not be considered out of place to allude to the charge which is constantly being advanced by physicians of eminence and large experience that training and athletics are pushed to a dangerous and unwarrantable extent at our public schools and universities. Now, with regard to growing lads, it has already been pointed out that all severe athletic contests ought to be avoided on physiological grounds, but in the case of young men, the danger is very materially lessened. No doubt, there is always a certain amount of risk, but the cases of permanent injury, or of "overstrain of the heart," are much rarer than is generally supposed, for even with regard to the University boat-race, which is one of the severest athletic contests of the day, Dr. Morgan, of Manchester, who was a crack oarsman himself, has clearly proved, by inquiring into the history of all those who have taken part in the race for years back, that the instances of actual mischief were rare or doubtful, and that, as a rule, the men have all along led vigorous, healthy, and active lives. At the same time, there can be no question that long running matches, or even the insane walking matches, which are now so much in vogue, are often productive of serious mischief, and ought to be discouraged in every way.

It now remains to say a few words with respect to diet during training. At one time, it used to be the practice to diet all pretty much alike, and to give far more animal food than could be properly assimilated. Nowadays there is more latitude allowed by trainers, but individual peculiarities are not yet so much taken into consideration as they ought to be. So long as the diet is plain, nutritious,

well-cooked, and sufficient for bodily requirements and the extra amount of exercise indulged in, it may be varied very considerably to suit individual tastes; but the meals should be taken at regular hours. Alcoholic liquors, if not dispensed with altogether, should be taken very sparingly, and in the form of beer or claret at dinner. Strong tea should be avoided, and smoking, if it cannot be given up entirely, should be indulged in as little as possible. A glass of milk or milk-and-water, with or without a dry biscuit, should be taken before the morning's run or walk which precedes breakfast, while soda-water-and-milk will be found to be a very safe and refreshing drink to allay thirst during the day. No more fluid should be taken than is actually required to allay thirst, or for the solution of food at meals, and it need hardly be said that a large draught should never be taken immediately before severe exercise is taken, because it impedes the full action of the lungs. For severe training, a diet which contains about 450 grains of nitrogen and 5000 grains of carbon will be found to be quite sufficient, while for moderate training, the quantities need not exceed 375 grains and 4600 grains respectively. Butcher's meat, bread, butter, vegetables, fruit, oatmeal, and milk may all be taken, and an approximate estimate of the relative amounts required daily may be obtained by consulting the tables which are given in the chapter on Food and Diet. Generally, the tendency is rather to over-feed, but if the diet is simple and wholesome, there is not much danger of erring in this respect.

As a guide to those who are desirous of putting themselves in training, the following hints, gathered from various sources, indicate the system which is pursued at the English Universities:—

Rise at 7 a.m. in winter and 6.30 a.m. in summer. Have a cold, tepid, sponge, or douche bath, according to indi-

vidual circumstances or season of the year, but in any case, have a good towelling afterwards. Then take half a tumblerful of milk or milk-and-water, with a dry biscuit or bit of toast. Afterwards take a brisk walk of two or three miles, with occasional runs, which may be gradually lengthened. Breakfast at 8 or 8.30, on steak, chop, or fowl, the amount not to exceed half a pound, with one boiled egg, stale bread or toast, with butter, and two cups of weak tea, or a cup or two of coffee or cocoa, with plenty of milk. Fish may be taken occasionally by way of change, but ham or bacon should be avoided, because they are apt to create too much thirst.

From 9 o'clock to midday, men are usually engaged in their ordinary pursuits, but after 12 they are generally free to take exercise, and this may be varied at rackets, fives, tennis, boxing, fencing, or in the gymnasium.

Lunch should not be later than 1 or 1.30, and should be as light as possible. A small basin of mutton broth or nutritious soup in winter, or a slice or two of cold meat in summer, with bread and butter, ought to suffice; while as regards drink, a glass of beer or a little claret-and-water may be taken, but water alone is preferable.

At 2.15 or 2.30 the real active exercise of the day is commenced. The rowing should be slow and steady for the first half-hour. Then varied afterwards to full or half speed, or from half-speed to full, steady or continuous, as the case may be, care being taken to train gradually, and to note any symptoms of distress amongst the members of the crew. After the row, the men should rub down with a wet sponge, followed by a good towelling, and then walk quietly back to their rooms, and rest till dinner. When the course is rowed, the time on the river should not exceed one hour and twenty minutes, and in any case the time should not exceed two hours and a half.

Dinner at 5.30 or 6. A little soup or broth in winter,

followed by roast mutton, roast beef, roast fowl, chop, steak, or dry mutton cutlets. Or, instead of soup, a little fish may be taken, and as adjuncts to the more substantial part of the meal, potatoes, vegetables, condiments, and bread. Those who like puddings may indulge in light, farinaceous puddings or cooked fruits; but in any case, the after-dinner morsel of cheese need not be dispensed with. The great thing to be guarded against is over-repletion, and if the meal is plain and substantial, it may be varied to any extent. As regards alcoholic liquors, they should be taken sparingly, if at all; not more than a couple of glasses of bitter ale, or two glasses of claret, or one glass of sherry, ought to be indulged in.

During the evening, a cup of tea may be allowed, and at 10 o'clock, a pint of gruel, or a supper somewhat similar to the breakfast, but lighter, may be taken, if the appetite is keen.

The time to retire to rest should not be later than 10.30 or 11; but before retiring, there should be some dumb-bell or club exercise, followed by a warm bath, or tepid sponging, especially if there is much muscular fatigue.

Such, briefly, is a sketch of the system generally pursued by university men who are ambitious to excel as rowing men, and it can hardly be said that the training, when judiciously carried out, is of a kind to over-tax the strength of any one of average physique. At the same time, there can be little doubt that many men devote too much attention to athletics, and too little to study or class-work, and this is an error in the opposite direction.

From childhood onwards, physical and mental culture should go hand-in-hand, and varied recreation is as necessary for the one as the other. But in either case, recreation should never be pursued to such an extent as to render it laborious or debilitating, nor should it be allowed to encroach upon the hours of natural rest, as it too often does

in the ball-room or at cards and billiards. Let there be less cramming, and more genuine education, in the real sense of the word, at our schools and universities; less forced work everywhere, and more recreative freedom; and withal, let parents and teachers alike keep constantly in view the supreme duty of inculcating those principles of morality, without which learning will fail to ennoble, and mere physical health fail to secure happiness.

CHAPTER VII.

THE HOME AND ITS SURROUNDINGS.

THOSE who are acquainted with the social history of England, and the home habits of the people during the dark or Middle Ages and even up to more recent times, will have no difficulty in accounting for the terrible epidemics which frequently devastated the country, and the excessive mortality from all causes which prevented any material increase of the population for centuries. The cities and towns were for the most part walled-in fortresses, and were therefore highly favorable to overcrowding and stagnant air. Cleanliness of person and home were alike utterly neglected, so that filth accumulated everywhere. With the exception of the castle, which was built more for defence than comfort, the homes of the people consisted almost entirely of hovels, with mud walls and thatched roofs, while the floors, which were generally made of loam, were covered with layers of rushes, and these being seldom removed, harbored all sorts of abominations. The streets were dark, narrow, and tortuous, unpaved, and without sewers or drains. The rural population, on the other hand, were scattered in slight hovels over dreary wastes and undrained marshes, so that rheumatism, ague, and other diseases were constantly rife among them. Among all classes, the clothing worn was immoderately thick and warm, and was seldom changed night or day. Add to all this that gluttony and intemperance were prominent characteristics of the sturdy fighting Briton of mediæval times, and it will be readily

conceded that the habits and habitations of our forefathers were alike inimical to health, and could not fail to foster epidemic diseases and preventable disorders of every description.

As time rolled on, improvements of an incidental kind were gradually introduced; but sanitary progress and the emancipation from the thraldom of filth were slow, tentative, and tedious. Indeed, it was not till the Great Fire in London occurred in 1666, and consumed everything from the Tower to Temple Bar, that people began to realize, though in a faint and glimmering way, the sanitary defences afforded by better-constructed homes, wider streets, and greater general cleanliness; nor was it until a century later that the labors of John Howard imparted an impetus in this direction which has proved of lasting national benefit. His name, as every one knows, is associated with the suppression of a fatal disease, called jail fever, which was constantly breaking out in prisons all over the country, and was continually spreading, by means of infection through the agency of discharged prisoners, amongst all classes of the community. The disease has long since been recognized to be the same as typhus fever, and John Howard the philanthropist was the first to prove beyond all dispute that it is a disease essentially engendered by filth and overcrowding. It would be out of place to enlarge on the incidents of his self-sacrificing labors here; but the outcome of them is simply this—that for years back the prisons of this country have been proved, by the most rigid statistics, to be far healthier than even the better class houses of the present day.

Coming now to the present century, we find that the progress made in the prevention of disease was very considerable. Thus, it is ascertained from the bills of mortality, that the death-rate of the city of London, which during the seventeenth century had averaged 80 per 1000 of the

inhabitants, had been reduced to 50 per 1000 during the eighteenth century, and since the Registration Act of 1836 was passed, it has averaged only 24 per 1000. But outside London, at the commencement of the present century, there were no large towns teeming with overgrown populations, none contained so many as 100,000 inhabitants, and only five exceeded 50,000. The population of England and Wales, which, in round numbers, was only 10,000,000 in 1810, had increased to over 15,000,000 in 1840, and at the present day, it nearly amounts to 25,000,000. And this rapid increase of population, owing to the opening up of new sources of industry, and the commercial prosperity which encourages early marriages, has taken place, for the most part, in already populous towns, or at centres of industry which speedily became populous. Old houses were overcrowded from cellar to attic, and the new houses which were run up, though improvements on the hovels already described, were built without the slightest regard to the veriest rudiments of sanitation. The drains were leaky, the sewers were badly constructed, cesspits multiplied, wells were polluted, and scavenging was everywhere neglected. At last, after many inquiries which revealed the terrible evils which were fast accumulating, the Legislature interfered, and by numerous Acts passed year after year, has of late endeavored to enforce better construction of houses, provide proper drainage and water supply, and to remove such other sanitary defects connected with existing premises as can be obviated.

But only those who are acquainted with the rookeries of our large towns, and the rickety cottages of our rural villages, can form any adequate conception of the gigantic nature of the task which has to be accomplished. A minimum of at least one-third of the village homes of England require to be pulled down stick and stone, and rebuilt, and that has been estimated to represent a mini-

mum outlay of seventy millions of money; while as regards the replacement of the reeking abodes and tenements of our large towns, more than double that amount will not solve the difficulty.

It sounds like a grim satire on the boasted civilization of the present day, but it is no less true, that the modern prison is in all sanitary essentials the best existing type of what a healthy dwelling ought to be, and even on that model there is considerable room for improvement. The real sanitary work of the architect and builder, therefore, lies entirely in the future, and though a long period may elapse before the same metamorphosis will be effected in the home and its surroundings as has been effected in the jail, we can at least say that the days of ignorance and of half-knowledge have gone by, and that the broad principles of sound sanitation are now so clearly defined, that it only requires time, money, and an ever-widening appreciation of the advantages to be gained, to have them fully and fairly carried out.

And here I may be permitted to observe that there is no writer of modern times who has done so much and striven so earnestly to instill these principles into the public mind as Dr. Richardson, true though it be that all the details so forcibly set forth in his "Hygeia" are never likely to be realized, nor, indeed, are they absolutely required. Still, it is well to insist upon high ideals, because they are the best encouragement to steady onward progress. So far as health is concerned, a kitchen on the third floor is greatly to be preferred to a kitchen on the basement and directly under the living rooms, but it would be quite as healthy to have it built in a separate back wing, as is done in many of the middle class houses which have recently been erected.

In house construction there is ample scope for architectural variety without adhering too closely to any model,

and in the following remarks it will be my endeavor to set forth such sound principles of sanitation, as have received general authoritative acceptance, and to point out at the same time how they may be applied to remove existing defects.

I. Site.

Unfortunately it is only the privileged few who have the advantage of selecting a site for a new house, but most people have the opportunity of choosing a locality or situation, where they intend to live; and in either case, there are certain important points which ought always to receive due consideration. In the first place, the soil should be dry, and if not perfectly dry it should be well drained. The healthiest soils are gravel, chalk, marl, and the looser limestone formations; but even the best soils may very soon be rendered unwholesome by imperfect or defective house drainage. Dampness of soil induces rheumatism, bronchitis, colds, and it is largely associated with that fatal disease, consumption. There is no doubt, too, that before the land was so well drained as it is now, it was the principal cause of ague, which was once so common and now so rare. In country districts many of the cottages are built against sloping banks, with mud or brick floors resting directly on the damp soil;—as far as possible these ought always to be avoided, because they are very unhealthy.

In the neighborhood of large towns, there is another serious evil which has to be guarded against, and that is, building houses on what is called made-up ground. There are whole streets of houses in Liverpool, London, and many other cities and towns, which have been erected on vast accumulations of rubbish which has been used to fill up the excavations made in brick-making; and the unwholesomeness of such sites may well be imagined, when it is explained that this rubbish consists for the most part

of ashes containing decaying animal and vegetable matter, street-sweepings, road-scrapings, and refuse of every description. It is not considered safe to build on such made-up ground until after a lapse of at least two or three years, and not even then unless it has been well drained and covered with an impermeable layer of concrete.

Then, again, it need hardly be pointed out that all hollows or low-lying localities, where water is likely to lodge, are objectionable, and so is the immediate neighborhood of sluggish streams and marshy estuaries, because in all such localities, not only is the subsoil damp, but the air itself is moist, and there is frequent liability to fogs. For these and other reasons, the best situation for a house is on rising ground or the slope of a hill, with trees in the immediate neighborhood, but not so close as to interfere with the free movement of the surrounding air. The aspect will very likely be influenced in great measure by the view to be obtained from the front windows, but it is preferable that the house should face east or south-east, because the morning rays of the sun penetrate to the front rooms, and in the afternoon they cheer those at the back. When, on the other hand, the house faces south, the front rooms are overheated in summer by the rays of the noontide sun, while those at the back are deprived altogether of direct sunlight. Many people have an objection to direct sunlight in rooms, because of its fading effect on the colors of carpets and curtains, but that may be guarded against by proper selection of blinds, and in any case, the gain to health should overrule any possible damage to furniture.

As regards other considerations, it may be said generally that the country is healthier than the town, and the suburbs, especially those situated on rising ground, are more suitable as places of residence than the interior of

the town. People, however, should hesitate before they choose a site or dwelling in an unfinished suburb, where there is no proper scheme of drainage or water supply. It is also obvious that squares, terraces, and avenues are preferable to streets, and wide streets to narrow streets, or close alleys and lanes. Other things being equal, a detached house is to be preferred to one semi-detached, and both to one in a street or row; but, in any case, there should always, where possible, be a certain amount of open, or garden, space behind, if not in front of the house. Houses which are built back to back should always be avoided, because any approach to proper ventilation is impossible; and for the same reason, houses which have no back doors are also objectionable. When it comes to be a question of living in tenements or lodgings, it need hardly be said that cleanliness and orderly neighbors should largely influence the selection of dwelling, in addition to considerations of rental and situation. Those who wish to maintain a clean and healthy home, should keep an eye on the sanitary condition of adjacent premises, and should avoid the close proximity of factories or other places where offensive trades are carried on.

In localities which are not provided with a public water supply, no site should be selected, unless it is quite certain that a sufficient supply of pure water can be obtained; and, indeed, by virtue of an Act passed last session, which applies more particularly to rural districts, no new house can be occupied, nor any house which has been rebuilt, unless a certificate is first obtained from the Sanitary Authority as regards the sufficiency and wholesomeness of this necessary of life. All persons, therefore, who intend to build in the country should first make sure of their water supply, either by sinking a well or otherwise, before they commence building operations. And here it

may be serviceable to point out that in all urban districts, or in rural districts which have been granted urban powers by the Local Government Board, all plans for new houses, or houses which have to be remodeled or rebuilt, have to be submitted for approval to the Sanitary Authority of the district, who are empowered to enforce certain conditions in respect to site, open space, structural details, ventilation, drainage, and the like. This is a very wise provision, and it is much to be regretted that it does not apply to every rural as well as to every urban district.

As regards other special sanitary conditions which ought to be carefully kept in view in the selection of a house, these will be more conveniently considered further on.

II. Structural Details.

In building a house, the work ought not to be commenced until all the details of drainage, water supply, ventilation, heating, lighting, and warming are clearly indicated in the plans and specifications of the architect; because it too often happens that, from inattention to these important details, and especially as regards drainage and ventilation, the house, after it has been finished, cannot be inhabited with safety until many and costly alterations have been made, which ought never to have been required. I am afraid that it still remains true that architects are too apt to sacrifice sanitary requirements to the exigencies of style, and over and over again I have been called upon to inspect new houses, in whose erection no money was spared or grudged, but in which illness had cropped up, or foul smells had been complained of, not long after they had been occupied, and generally through some glaring mistake connected with drainage.

Having selected a healthy situation, and taken care that dryness of the subsoil has been secured by proper drainage if there is any tendency to dampness, the next

important point, after laying the foundations, is to lay a bed of concrete over the whole site, in order to prevent any exhalations of the air which is contained in the interstices of the soil. Gases of all kinds will find their way through the soil into houses, and especially if the soil is porous. Even as regards cottages, a bed of concrete will greatly modify the effects of positions which in some respects may be objectionable, and prevent much of the dampness and malarial mischief to which the inmates of cottages are too frequently exposed. Unless it is absolutely necessary, no drain should ever traverse the basement of a house; but when it cannot well be avoided, as when houses are joined together in streets and squares, every such drain should be made absolutely air and water tight. It should be constructed of glazed earthenware pipes, laid on a bed of concrete, securely jointed, covered with concrete, and provided with full means of ventilation and inspection at either side of the basement. When such drains have to pass through foundation walls, arches should be thrown over them to prevent any breakage should there be any subsequent settlement.

In order to prevent damp from rising into the walls—and there is great risk of this when the bricks are porous—a damp-proof course should be laid over the whole of the foundations about a foot or so above the level of the ground. Two or three courses of slate laid in cement will answer the purpose, or a course or two of enamelled bricks; but the best articles for the purpose are vitrified stoneware tiles about one inch and a half thick, and perforated in order to secure free ventilation beneath the joists of the floor. When these tiles are not used, it is essential to insert perforated bricks at proper intervals for ventilation, otherwise the timbers will become liable to dry rot. In houses where no damp-proof course has been provided, it not unfrequently happens that the ground

wet will rise through the bricks to a height of ten or twenty feet, and sometimes higher. The entrance of underground damp may also be prevented by constructing what are called dry areas—that is, by leaving a space between the main wall and a thin outer wall, the two being joined together by stretching bricks. The great majority of old houses and many new ones have foundation or basement walls without dry areas of any kind, and the consequence is that the water from the saturated earth which abuts against them, is constantly trickling through them. The bottom of the dry area should be concreted over and drained, and means should be provided for ventilation, otherwise foul air will very likely accumulate in the open space between the walls.

The ground floor of a house should not be below the level of the road, street, or ground outside. Kitchens in the basement story are always inconvenient and dingy, generally more or less unhealthy, and, owing to their situation, permit the smells of cooking to ascend all through the house. Bedrooms for servants in the basement are still more objectionable. They are always dark, badly ventilated, stuffy, and close, and though they are to be found in this situation in many of the best class houses in London and other large towns, there can be little doubt that they are detrimental to health. Indeed, it cannot be too strongly insisted on, that free ventilation and sufficiency of light are impossible in underground basement stories, and they should only be used for wine-cellars, coal-cellars, and lumber-rooms.

Without relegating the kitchen and servants' rooms to the upper story, as proposed by Dr. Richardson, a more convenient and equally healthy plan, as already pointed out, is to build the kitchen, larder, scullery, and other offices, in a distinct offshoot, or wing, behind the house, and on the ground floor.

The bedrooms for servants may then be built over the kitchen, and can be approached by a separate staircase. Kitchen wings of this description are found in many of the best class houses in the suburbs of Leamington and elsewhere, and possess the special advantages of convenience in administration without any of the disadvantages attaching to underground kitchens.

Reverting now to the structure of the walls and other details, it has to be pointed out that as much of the dampness of brick walls depends upon driving wet, the walls of a well-planned house ought to be built hollow, with binding bricks laid in at regular intervals to render the strength and stability of the twin walls equivalent to strong single walls. Many kinds of bricks are so soft and porous that a single brick will absorb nearly a pound of water, and when single walls are built of such materials, it is impossible to keep out driving wet, unless they are slated or tiled over, or coated on the outside with one or other of the several waterproof silicate compositions which are well recommended. Sometimes glazed bricks are used for outside walls, but all materials which prevent the entrance of driving wet likewise prevent the exudation of any moisture which is sure to collect in the inner portions of the walls, and this moisture will make itself apparent on the internal surfaces. As Professor Pettenkofer of Munich has pointed out, impervious walls resemble india-rubber textures in this respect, that while they protect from wet without, they generate dampness in the interior by impeding the exchange of inside and outside air, and thereby preventing evaporation. The healthiest kind of walls, therefore, are hollow walls constructed as described. They render a house cool in summer and warm in winter, and, owing to their porosity, are readily cleared of moisture. For the reasons just stated, it is also obvious that interior walls should not be painted or varnished over.

It is much preferable that they should be merely distempered, and by means of stencilling or water-color painting as much flat ornamentation can be obtained as need be desired. Ordinary plastering will not render the walls impermeable, but when they are painted, or covered over with thick papers, or varnished, they should be specially well ventilated.

It is needless to say that the rooms of a well-planned, healthy house, should be lofty, airy, and light. The windows should reach to near the ceiling, and should be made to open at top and bottom. If it be desired to secure extra warmth, plate glass should be preferred. No single bedroom should contain less than 1000 cubic feet, nor should any bedstead be fixed in a recess. Indeed, there should be as few recesses and dark corners as possible, and far more consideration ought to be paid to the bedroom accommodation of servants than hitherto has been the custom. As already stated, they have often either to sleep in dark, stifling, underground catacombs, or they have to huddle in attics, frequently under the bare rafters, where they are perished in winter and suffocated in summer. Bedrooms in attics should always be ceiled and plastered, have an average height of not less than eight feet, and if no fireplace is provided, they should have a special ventilating shaft and be well lighted.

In order to economize heat and secure warmth, it is a good plan to arrange the chimney-stacks or flues as near the centre of the house as practicable, and for purposes of ventilation it is very desirable that alongside the chimney-flues, there should be built in the chimney-stacks a separate flue opening near the ceiling into every room. These flues act as very efficient extraction shafts, because, being warmed by contiguous chimney-flues, a constant upward current of air from the different rooms is induced. As a further assistance to efficient ventilation hall space

is very valuable, and the hall should have a back as well as a front entrance. If the hall is also warmed by a ventilating stove or grate, or hot water pipes, and the rooms ventilated as described, it may be made to form the base of a large ventilating shaft, which may be louvred or ventilated by a skylight in the roof, and in which the staircase and separate landings are placed. And here it may be pointed out that among stoves which are well adapted for warming and ventilating halls, may be mentioned Pierce's Pyro-pneumatic Stove, Musgrave's Slow Combustion Stove, Bond's Euthermic Stove, and George's Calorigen Stove. When these arrangements with regard to ventilation of rooms, and the warming of the hall itself are not adopted, this plan, though affording an efficient upcast shaft, is apt to convey vitiated air from the rooms below to the bedrooms above, and to create unpleasant draughts on the staircase and landings.

Another very important detail in the construction of new houses is the situation of water-closets. In large numbers of old houses, and even in many which have recently been built, the closet is placed somewhere in the interior of the house, where it cannot be properly lighted, and where adequate ventilation is next to impossible. It is here that sewer gas finds a ready entrance, in spite of trapping and so-called attempts at drain ventilation, and the amount of preventable disease and death which has been traced to this cause in all parts of the country is so enormous that it could hardly be credited, even if exact statistics could be placed before the reader.

The best of all positions for water-closets is to erect them in an isolated block, built tower fashion, and abutting against an outer back wall of the house, with a closet on each floor if deemed necessary, and the supply cistern on the top. There should be a small ante-room or passage between each closet and the house, but large enough to

admit of sufficient cross-ventilation by means of open windows, windows with ventilating panes, or special ventilators. A double set of doors would be required—one leading into the house, which might be a swing door, and the other cutting off the passage from the closet. The closet itself should be well lighted by a window having double sashes, and extending up to the ceiling; and in order to ensure that it shall always be well ventilated, it is a very good plan to keep the top half of the window permanently nailed open for some distance. This is especially necessary when the closet is not cut off from the rest of the house as here recommended, because any foul effluvia are much more likely to be drawn into the house on account of the inequality of the inside and outside temperature, and particularly during cold weather. Additional ventilation may be secured by inserting perforated air-bricks in the outer walls, and close to the ceiling. In smaller-sized houses the closet may be simply projected from the building, with the seat facing the door, and with two opposite windows reaching to the ceiling, and situated between the seat and the door, both of which ought also to be kept fastened down for some distance. Cross-ventilation and sufficient light would thus be obtained without the interposition of an ante-room. When either of these precautions with regard to the situation of the closet is not adopted, it should be situated against an outside wall so that the soil-pipe can always be carried outside, and ventilated by a special pipe reaching above the eaves, and of the same calibre as the soil-pipe. Most of the ventilating pipes which plumbers attach to soil-pipes are far too small, and in consequence of their size, and the acute angles at which they are often bent, they are practically useless. They ought, at least, to be three or even four inches in diameter, and should be carried straight above the eaves, or with as few bendings as possible. The soil-

pipe itself should never be plastered or built into the wall, but should be left free for inspection throughout its whole length. Of course, it may be boarded in, but the boards should only be screwed on, so that they could at any time be readily removed. Moreover, the soil-pipe should not be made of lead, because the lead is apt to become corroded by sewer gas, but it should be made of iron or earthenware, and should not exceed four inches in diameter.

As regards the closet apparatus, there are now so many patents so well arranged in all their details, that it is difficult to say which of them are most deserving of recommendation. There are others, again, such as the round hopper closet-pan fixed into an ordinary sigmoidal bend, or the ordinary closet-pan with foul D-trap, which cannot be sufficiently condemned. Generally speaking, those closets are the best which provide for efficient and rapid flushing without permitting reflux of foul air, and which contain a sufficiency of water at all times. Every detached closet should be provided with a cistern, preferably of the waste-preventing class, because it is of the utmost importance that there should be no direct connection between the closet-pan and the water-main—an arrangement, however, which is still allowed to prevail in many towns. In localities where there is no public water supply, the closet is sometimes flushed by a bucket or pail, but in these cases it is preferable to provide a large cistern for the collection of roof-water, otherwise the flushing is apt to be imperfect, and at times neglected altogether. Of course, the cistern can also be supplied by a force-pump; but whenever there is any difficulty about water, some form of dry closet ought to be adopted instead. But whether the water be derived from a public supply or from a well, it should always be borne in mind that the same cistern which supplies the closet ought on no account to supply the drinking water, otherwise the sewer gases from the

closet are liable to become absorbed by the water in the cistern to such an extent as to render it highly polluted, and altogether unfit for use.

Without entering with undue minuteness into these somewhat unsavory details, it may be said generally that the closet-pan should be roomy, and be made of white glazed earthenware; and the seat should be so framed as to come asunder readily to permit of inspection. Among closets which have been found to work very well may be mentioned the "Excelsior Water-Closet," manufactured by Mr. Bostel, Brighton, which has gained the medal of the Sanitary Institute of Great Britain; several kinds of closets patented by Mr. Jennings; Banner's Closet; Minn's Closet; and Dodd's Closet, of Liverpool.* The flush-pipes leading from the cistern ought to be, at least, one inch and a half in diameter, to ensure a good rush of water.

The only kind of closet which can be tolerated inside a house is a water-closet, for even a dry-earth closet indoors is objectionable, on account of the scavenging which it entails, unless it is placed against an outside wall on the ground floor, and an opening is provided with a door through which the pail or pan can be readily removed. Outside closets, other than water-closets, should be so situated and constructed as to not be productive of offensive nuisance of any kind. The old-fashioned kind of closet, with its fœtid cess-pit behind, is always more or less of a nuisance, no matter where it is situated, and should be done away with altogether. It is especially objectionable in connection with schools in rural districts, and I have often traced serious outbreaks of disease among the children to the foul effluvia which it generates. Very

* Of the varieties here spoken of, Jenning's Water-Closets are used to some extent in the United States, and can be readily procured in all our large cities. Several other patterns are, however, more highly esteemed, and among these may be mentioned Hellyer's, and also Rhoads' Cistern, water-closets. The latter form seems to combine all the chief desiderata of a perfect water-closet to an unusual extent.—R.)

frequently there is an ash-pit built in connection with the closet, but as a rule, this is always too large and too deep, permitting of unwholesome accumulations and the entrance of surface-water. If an ash-closet is to be tolerated at all, it should be made small, shallow, and should have a covering over it to keep out the wet, and sifted ashes or dry earth should be used in sufficient quantities to prevent any smell. But by far the best kind of outdoor closet is one in which a galvanized iron pail or box is used, and either dry earth or ashes added by special apparatus, such as in Moule's Closet, Parker's Closet, or Moser's Closet,* or the apparatus may be dispensed with, and the dry earth or sifted ashes be supplied from an ordinary receptacle placed in the closet. The advantages of using a pail or box are twofold, because, in the first place, all soaking into the surrounding soil is obviated, and in the second place, frequent and regular scavenging becomes necessary, thereby preventing any undue accumulation of foul matters near the dwelling. These matters can either be at once dug into the garden, disposed of as manure, or they can be stored in a remote corner of the garden by digging a hole and covering them over with a layer of garden mould.

Bath-rooms and lavatories can be placed where most convenient, but it is desirable that they should not be in too close proximity to water-closets, and that they should be situated on the bedroom floors. The waste-pipes from them should never be made to discharge directly into the soil-pipe or drain; but should always be carried outside and disconnected.

---

* Moule's Closets were patented some years since, in the United States, and have been largely manufactured by the Hartford (Conn.) Earth Closet Company.' Practical difficulties, however, in regard to the procuring and subsequent disposal of the great amount of dry earth required, seem to have seriously interfered with the success of the enterprise in this country.—(B.)

III. Drainage.

It has already been pointed out that, unless when absolutely necessary, no drain should traverse the basement of the house, and when it does become necessary, special precautions which have previously been described should be adopted. But unfortunately in almost all towns the main sewer into which contiguous houses drain is laid under the street, and consequently the house-drains have to be carried under the houses to discharge into the sewer. A much better plan is to construct the main sewer along the backs of houses, because by this arrangement the house-drains can be laid directly away from the houses, and the pipes from sinks, sculleries, bath-rooms, and closets, can all be made to discharge without difficulty in the rear. If the public sewer is not behind the house it is advisable, if possible, to carry the house-drains round the house rather than under the basement; but in any case the house-drains should be laid at a sufficient depth below the basement to carry off all refuse-water and drain the cellars. It need hardly be said that they should be made of glazed earthenware socket-pipes, well laid, securely jointed, and with a proper fall. The main drain into which the soil-pipe discharges should be trapped and disconnected from the main sewer at some point outside the outer wall, and it is highly desirable that it should also be ventilated at this point by a special pipe, or by some contrivance such as Pott's Trap, Banner's Trap, Buchan's Trap, or Weaver's Ventilated Syphon Trap.* All other pipes, such as sink-pipes, scullery-pipes, pipes from lavatory or baths, and rain-water-pipes, should be carried outside the walls of the house, and be made to discharge

* With us Dubois' Drawn Lead Trap, and Low's Cast Trap (both ventilating traps,) and Bower's Ball Trap (which should only be resorted to when due ventilation is impossible) are more frequently employed.—(R.)

in the open air on to trapped gratings communicating with the house-drains. By adopting these precautions any ingress of foul air through these channels is obviated; and if the house-drains themselves are efficiently disconnected, trapped, and ventilated as indicated, the risks from the contamination of the air of the house by sewer gas are reduced to a minimum. There is, however, another important precaution which has to be pointed out. In houses with underground cellars, there are generally to be found one or more trapped openings communicating directly with the house-drains, and it too frequently happens that the traps become practically useless, because the water in them speedily evaporates and is not replenished. Every cellar-drain, therefore, should be disconnected outside the wall of the house by constructing a special dry area, if there is no open area round the house, and ventilating the house-drain by a special pipe at the point of disconnection.

As already indicated, all ventilating pipes should be at least three inches in diameter, and should be carried above the eaves. It has been urged, by way of objection to this plan, that where houses are closely packed together, and are of different elevations, the sewer gases discharged from the ventilating pipes of the lower houses would find their way into the higher, and thus become not only a nuisance, but a source of danger. With ample sewer ventilation, however, the objection does not hold good, because, when public sewers are well ventilated and kept properly flushed, the sewer air is so diluted as to be inoffensive and comparatively pure; besides, in cases where it is proved to be offensive—and, so far as my own experience goes, these are very rare—some such mutual arrangements as are adopted with regard to offensive chimneys, would meet the difficulty. Hitherto the rain-water-pipes have been largely used as ventilating shafts,

and for that purpose, or for convenience, have been laid directly into the house-drains; but the plan is highly objectionable, because in most cases their upper ends open very near to windows, and also because they are least efficient as ventilators when they are most required—that is, when there is a heavy fall of rain. The rush of water down them, while it displaces the air in the house-drains and sewers, prevents the air from ascending through these channels so long as the rain continues.

And now a word or two with regard to traps. That too much reliance has been placed by architects and builders on the efficacy of these contrivances for the exclusion of sewer air from houses, is becoming every day more and more evident. Up till quite recently, no adequate provision was made for drain or sewer ventilation, and the consequence was that mechanical ingenuity has been taxed to the uttermost to prevent the pent-up sewer gases from forcing their way through the terminals of drains, which, for the most part, were situated inside houses. When hot water is poured down a drain, or when a sewer becomes suddenly charged with a large volume of water, as after a heavy fall of rain, the forces which are brought to bear within the sewer are far greater than the resisting power of any trap, and consequently the displaced gases often make their escape at points where they are the most dangerous. There are few traps whose resisting power exceeds that of a column of water an inch and a half in depth; indeed, the greater number of them, as, for example, common bell-traps, have only a resisting power of about one quarter of an inch. Besides, it should be remembered that the water in an otherwise very efficient trap will absorb sewer gas on the one side, and discharge it but little changed on the other. All traps, therefore, should be regarded as at the best auxiliaries only; for in no case will they afford protection

against the ingress of foul air, if proper ventilation be neglected between the trap and the sewer. Some traps, again, such as the common bell-trap, are worse than useless, because they are readily removed, often forgotten to be replaced, and are easily broken. The most useful are either of what is called the mid-feather description, with one or more partitions dipping into the water, or constructed on the syphon principle; but in any case, their efficiency depends entirely on the continuous presence of water in the trap. They should be so situated and so constructed as to admit of ready inspection, and they should be examined and cleaned out at regular intervals. Sink-pipes, even when disconnected outside and made to discharge on to an open grating, should be provided with article-intercepting traps, and all bath and lavatory pipes, although disconnected in the same way, should be syphon-trapped to prevent the entrance of cold air.

In addition to sound construction, efficient ventilation and trapping, it need hardly be added that the drains themselves should always be kept well flushed. The special points with regard to drainage which should be inquired into before occupying a house which has already been tenanted, although generally indicated by the details which have just been submitted, will be more particularly alluded to in a subsequent page.

The next important question for consideration is the disposal of the sewage. In towns and suburban districts where public sewers have been constructed, all that is required is to lay the house-drains into them; but as regards scattered houses provided with water-closets, or houses situated in villages where there is no proper system of drainage, a cesspool is required to receive the sewage. This should be situated at a considerable distance from the building, and at a safe distance from the well. It should be made perfectly water-tight, by constructing the

walls of cement, or brick-work set in cement and surrounded with clay puddle. Both roof and bottom should be arched, the roof provided with a man-hole and properly ventilated, and the bottom built with a fall towards one end, where a chain-pump could be fixed. The depth should not exceed six or seven feet, otherwise the increased hydrostatic pressure would necessitate expensive walling. To separate the solids from the liquids, a galvanized iron wire diaphragm or grating, should divide the tank into two parts. All cesspools should be regularly and frequently cleaned out, and it is of the utmost importance, as already pointed out, that the house-drains leading into them should be efficiently trapped and ventilated. If the cesspool is situated in a field or orchard some distance from the house, the liquid contents can frequently be satisfactorily disposed of by constructing an overflow-pipe leading into sub-irrigation drains, either with or without a flush-tank. These sub-irrigation drains are made of loose tiles, laid about a foot beneath the surface, so as to permit of the sewage oozing into the soil, while the flush-tank devised by Mr. Roger Field, C. E., acting by means of a syphon, empties itself whenever it becomes full. When the sewage has to be pumped out, either a hose or a small tank on wheels will be required, and it can then be utilized in any part of the orchard or garden. No rain-water or subsoil drainage should be allowed to enter the cesspool, otherwise the difficulty of dealing with the sewage will be greatly increased. Although cesspools constructed on these principles may be rendered entirely free from danger, they should only be adopted for isolated houses, and wherever there is a public sewer within easy distance, they should be abolished altogether.

With regard to the disposal of mere slop-water from isolated houses not provided with water-closets, the difficulties are materially lessened. In villages, the slops are

generally made to discharge, by very imperfect drains, into the old road-drains; but as it is very seldom that any of these drains enter houses, the principal danger is soakage into neighboring wells. Where there is sufficient garden space, and the ground slopes away from the house, they can be got rid of without much trouble, and in many cases they can be made to discharge into some neighboring ditch without creating nuisance; but in every instance where there is danger to a well, the drains should be carefully laid, properly jointed, and always kept well flushed.

IV. Water Supply.

It has already been shown in Chapter III. what a large amount of preventable disease depends upon impure water, and especially when the impurity is of animal origin. Outbreaks of cholera, typhoid or low fever, diarrhœa, dysentery, diphtheria, ulcerated sore throat, and minor ailments, have over and over again been traced to this source, and it therefore behoves every householder to assure himself that his water supply is uncontaminated and otherwise fit for use, and that the quantity is sufficient for every purpose of health and cleanliness.

In towns provided with a public water supply, the amount consumed, including the quantity required for trade and municipal purposes, is estimated at about twenty gallons for every inhabitant daily, when there is no undue waste; but in many towns the actual amount varies between thirty and forty gallons. On the other hand, in villages and outlying districts, where water is by no means plentiful, the amount very often does not exceed three gallons per head daily; but this is not sufficient, and cleanliness of person and home cannot be maintained.

Public water supplies are regulated either on the constant, or what is called the intermittent, system, the former implying that the public mains are always kept fully

charged, and the latter that they are only charged during a certain number of hours out of the twenty-four.* The intermittent system, therefore, necessitates storage in house-cisterns, and is otherwise attended by so many disadvantages that the constant system should always be adopted wherever it can be carried out. The use of cisterns, except on a small scale for water-closets and boilers, is open to the great objection of the risk of contamination of the water; for not only are they liable to become fouled if not sufficiently protected against the entrance of aerial impurities, but the water is apt to become tainted with sewer gases if the same cistern is used to supply the drinking-water which supplies the closet, or if care is not taken that the overflow-pipe does not discharge directly into the soil-pipe or house-drain. Moreover, in poorer districts, the cisterns are often of a very inferior description, are badly situated, and are rarely inspected or cleaned out; or it frequently happens that there are no cisterns at all, and the water has to be stored in buckets and other open vessels which are not always clean and do not keep out dust. It is further urged against the intermittent system, that the distribution pipes and public mains being alternately charged and empty, are liable to become corroded, collect dirt, and permit the entrance of gases from sewers, drains, or neighboring gas-mains. In every respect, therefore, the constant system is to be preferred to the intermittent system, and provided there are proper fittings, strict regulations, and efficient supervision, a constant supply requires a less amount of water than an uncontrolled intermittent supply, so that on the score of economy alone it should always be adopted by public authorities.

In many towns, however, the house-fittings are so imperfect that the intermittent system is still carried on,

* This intermittent plan of water supply, with its imminent risk of water contamination, both direct and indirect, is fortunately almost unknown in America.—(B.)

because the waste from leaky taps would be enormous, and thus a certain amount of storage in every house becomes necessary. In other words, one or more cisterns must be provided, and with regard to these, special precautions are essential. In the first place, it is of the utmost importance, as already stated, that the cistern which supplies the closet should not supply the drinking-water, otherwise there is the constant risk of contamination of the water by foul air; in the second place, the overflow-pipe from the cistern which supplies the drinking-water should be carried outside and made to discharge in the open, either on to a trapped grating or on to some rain-gutter under the eaves; and, in the third place, the cistern should be properly constructed, conveniently situated for inspection, and thoroughly cleaned out at least once in three months. The best materials for construction are slate-slabs well set in cement, or galvanized iron. Leaden cisterns are always objectionable, and especially if the water is soft. All cisterns should be covered in, and protected from heat and frost. The inlet to every cistern ought to have a valve-cock, with a float to rise and stop the supply when the cistern is full; and the overflow should be so exposed as to be at once detected, to prevent waste. When the supply is intermittent, well-arranged houses ought to be provided with at least three cisterns—one to be exclusively used for drinking-water and cooking purposes, one for general household purposes, and one or more for closets.

All water-pipes leading from mains should be so arranged that they can be readily examined, whether inside or outside the house; and it is very desirable too that there should be a stop-cock on the private main leading to the house, by means of which the water can be cut off when any of the pipes burst or become leaky. The pipes themselves should be tinned, if not made of iron throughout their whole lengths, and they should be protected

from frost and direct heat of the sun when carried up outside the walls.

In towns supplied on the constant system, storage to any extent is not required, but cisterns are necessary for closets, and these should be of small dimensions, and of what is called the waste-preventing kind. The water used for drinking and other purposes should be drawn directly from the main, and the taps should have screw-down cocks to prevent leakage.

Coming now to the consideration of the water supply available in rural districts, it may be said at the outset that this is often scanty, and, where plentiful, it is much more liable to pollution than when obtained from public sources. It is derived either from wells, springs, streams, ponds, or collected as rain-water from the roofs. Where the level of the underground water is within easy reach of the surface, pump-wells or shallow dip-wells constitute the usual source of supply, and these, unfortunately, are liable to become polluted in many ways. Shallow dip-wells are always objectionable because dirty vessels are often plunged into them, and they admit surface impurities far more readily than pump-wells; but wells of any kind, when sunk close to the houses, are often in dangerous proximity to leaky drains or cess-pits. Another source of danger is that the upper part of the well is seldom clay-puddled to a sufficient depth, nor is the covering so evenly and imperviously laid as to keep out slop-water. Frequently, too, a well, in other respects good, becomes ultimately polluted because it is never cleaned out; and I regard this periodic cleansing of wells so essential that I think every pump-well should be provided with a properly constructed man-hole for purposes of inspection and cleansing, and that the well should be cleansed at stated times. Any deep ash-pit, cess-pit, or other filth accumulation in the neighborhood of a well should be regarded as a dan-

gerous nuisance and at once removed, and special care should be taken that neighboring drains are properly constructed and not leaky. Wells which are close to farmyards often become polluted, and should always be regarded with suspicion.*

Specially fitted for use in rural districts are the wells known as Norton's Abyssinian Tube-wells. They consist of narrow iron tubes driven or screwed into the ground in lengths, and with the lowest length perforated and pointed at the end. As no well is dug, the dangers arising from the entrance of surface impurities are entirely obviated, and they possess the further advantages of being driven into any good water-bearing seam which may be selected, of securing a sufficient yield in dry seasons, and of entailing comparatively little outlay either in their first cost or in sinking. The bore of the small tubes has a diameter of one inch and a quarter, and frequently a well sixty feet deep can be sunk in two days, which will yield an abundant supply of pure water within a few hours after completion. For great depths, and through strata which cannot be pierced by percussion or displacement, boring would, of course, be necessary; but it may be said generally that wherever pump-wells are in use these tube-wells can be sunk. If the water-bearing seam consist of running or loose sand, the water will require filtering for some time after the well has been sunk, but in most cases the yield becomes quite clear after a very short period, so soon as a cavity of some size has been formed round the perforated point by suction of the sand.

But there are many parts of the country where the geological formation is such that wells of any description

---

* In many parts of our country privy-wells and cess-pits (the contents of which will sometimes soak diagonally through the earth for 80 or 100 feet, carrying the germs, perhaps, of cholera or typhoid fever) *feed* the drinking-water wells, and these latter in their turn *feed* the grave-yards of the villages and rural districts where such criminal poisoning of the water supply is allowed to occur.—(B.)

are out of the question, and in these cases the supply must either depend on storage of the rainfall, neighboring streams, springs, ponds, or land-drains. The water from small streams and land-drains is generally more or less impure, and should always be carefully filtered, even when there is no suspicion of sewage pollution. Pond-water is also objectionable for drinking or cooking purposes. Rain-water, when properly stored, though somewhat flat, is pure and wholesome, but as dust or other impurities are liable to collect on roofs, it should likewise be filtered before being used. If it is stored in an underground tank, the tank should be made water-tight by cement, ventilated, and any overflow-pipe should be carefully disconnected so as not to discharge directly into a drain. Very frequently the water in soft-water tanks becomes so horribly polluted in this way, that the water actually stinks when it is pumped out, and is utterly unfit even for washing purposes. Whenever it is used for drinking or cooking, the receptacle in which it is stored, whether tank, cask, or tub, should be kept scrupulously clean, and should be covered over, to prevent the entrance of aerial impurities.

Villages in which the water supply is scanty should be provided, like towns, with a public supply, and Sanitary Authorities are empowered by the Legislature to carry out the necessary works. In accordance with the provisions of the Public Health (Water) Act, 1878, they can also compel the owner of any single house to furnish a proper supply, provided the cost does not exceed a certain amount, or they can give notice to owners of neighboring houses to join together to furnish a supply sufficient for those houses, if it can be done within certain limits of expenditure. Another very important clause of the same Act, as already pointed out, prohibits the occupation of any new house, or any house which has been rebuilt, unless the Sanitary Authority of the district is first satisfied

that the water supply is sufficient in quantity and of good quality.

And now a few words with regard to filters. The best filtering media are spongy iron and animal charcoal; and amongst filters to be commended may be mentioned, Bischoff's Spongy Iron Filters, Bond's Filters, Spencer's Carbide of Iron Filters, Atkin's Filters, and Lipscombe's Filters. All of these do their work very well, but they all require to be regularly cleaned, and if the filtering medium is charcoal, it should not only be carefully washed, but should occasionally be subjected to a red heat on a shovel or in a stove. To those who cannot afford to buy very expensive filters, the cheap charcoal block filters may be recommended, or the small floating syphon filters devised by Dr. Bond. The latter are very portable and convenient, and are admirably suited for those who intend travelling abroad. The filter itself consists of a hollow metallic vessel, which may be placed in a pail, jar, or other convenient vessel, and from which it will filter the water at the rate of from one to several gallons a day. It can be readily regulated and cleaned; and as any suspended impurities are kept outside the filter and allowed to gravitate towards the bottom of the containing vessel, it is not liable to become clogged up. Another very cheap filter, as suggested by the late Dr. Parkes, may be improvised as follows:—Get a good-sized earthenware flower-pot; cover the hole with a small piece of zinc gauze, flannel, or perfectly clean sponge; then get some fine gravel, wash it well, and put it into the pot to a depth of about three inches; then procure white sand, wash it well, and add a layer of about the same depth; then buy some 2 lbs. of animal charcoal, wash it well in boiling water, lay it over the sand to a depth of about four inches, and press the whole well down. The filter is now ready for use, and all that is required is to place it over some

vessel to catch the filtered water as it runs through. When the charcoal becomes clogged, it should be well washed in boiling water, and heated over the fire or in the oven; while the other layers can be renewed as required.

But no matter how efficient a filter may be, it should always be remembered that mere filtering can never be depended on to purify a water which is contaminated with sewage or contains the germs of infectious disease. Such a water is altogether unfit for use, and should be avoided as poison. Whenever, therefore, there is any reason to suspect that a water is polluted in any way, it should either not be used at all, or, if used when no other water can be procured, it should always be boiled as well as filtered; and a sample should be at once submitted for analysis, or the case reported to the sanitary inspector of the district, in order that some definite action may be taken without delay.

Although it is difficult to lay down any directions which may conveniently indicate the quality of water, the following hints may be useful:—A good water should be clear, colorless, tasteless, without any odor or dirty deposit, and free from floating filaments or particles. Any water which tastes bad, or has a disagreeable odor, or contains a dirty sediment, or floating particles, or becomes muddy after rain, is a suspicious water, and should always be boiled before being used.

V. Ventilation, Warming, and Lighting.

I place these three important essentials of a healthy house in the same category, because their action and influence are so interdependent—if I may use the phrase—that they cannot well be treated separately. I shall also avoid as far as possible dealing with doubtful theories or details by endeavoring to lay before the reader well-ascertained facts and principles, and explaining such expedients

or contrivances as have been proved to work satisfactorily.

It has already been shown in Chapter III. that the air of a room may be vitiated in many ways—by the carbonic acid and effete matter given off by the lungs, by excessive moisture or excessive dryness, by foul effluvia, or by infective germs or particles; but whatever the cause of deterioration, the cheapest and most effectual remedy is good ventilation—in other words, the foul air must be continuously removed and continuously replaced by fresh air. But in a climate so variable as ours, it likewise becomes evident that this interchange of air should take place without creating unpleasant draughts or discomfort of any kind. We have, therefore, to ascertain first—how much fresh air is required to keep the air in an inhabited room from becoming too close? and, secondly—at what rate can it enter without creating unpleasant draughts? and both these are problems in the solution of which the number of occupants and the size of the room must be taken into account.

Now, without going into details, I may say at once that the broad results which have been arrived at by those who have experimented most largely on this subject, are these, and they apply specially to bedrooms:—(1) The cubic space per head for every individual should be 1000 cubic feet—in other words, a bedroom ten feet square and ten feet high, ought only to contain one person; and (2) the amount of fresh air entering the room should be 3000 cubic feet per hour for every occupant in order to prevent undue accumulation of the impurities of respiration, and avoid disagreeable draughts.

These are the standards to be aimed at to secure comfortable and well-ventilated bedrooms; but except it be in the better class of houses, I need hardly say that they are seldom or ever attained. And, indeed, even in

the best houses, as has already been pointed out, the kind of bedroom accommodation allotted to servants is too often a scandal and a shame. Their beds are too frequently placed in low attics, out-of-the-way corners, or basement dungeons, where the breathing space, and the most ordinary means of ventilation, are alike grossly insufficient. But in the homes of the poorer classes, the cubic space for each individual, instead of approaching to 1000 feet, in numbers of cases does not amount to 200 feet. In common lodging-houses, the minimum is fixed at 300 feet, not because this space is sufficient to meet the requirements of sound health, but because a larger space cannot be fairly insisted on when the house-accommodation of the general population is taken into account. The rule should be—try and get 1000 cubic feet of sleeping space for each person if it can be obtained, and do not keep a spare bedroom in the house unoccupied if the average space without this room is reduced to below 600 cubic feet.

And now a few words with regard to the ventilation of bedrooms. I need not say that every bedroom window should be made to open. If there is no fireplace, there should always, if possible, be some other opening; and in the majority of cases, it will be found that such an opening could be readily made into the chimney flue proceeding from the room beneath, by inserting what is called an Arnott's Ventilator or Crossley's Valve near the ceiling. Both of these ventilators are so arranged that they permit the escape of foul air up the chimney, but at once close if there is any down draught, and thus prevent the entrance of smoke. In all new houses, the by-laws applying to urban districts insist that, in the absence of a fireplace, some special ventilating shaft shall be provided. If, however, there is a fireplace in the bedroom, care should be taken to have the flue always open, and not

stopped up or obstructed by furniture, because it acts as a very efficient extraction flue. Then, too, it is very desirable that the window, especially if there is any tendency to overcrowding, should always be kept a little open at the top. Another very good plan is to raise the window at the bottom two or three inches, and insert a piece of wood the whole length, so as to support the sash, and close the opening; the air then enters between the sashes, because the lower sash is raised above the lower part of the upper, and in this way it passes up towards the ceiling without creating unpleasant draughts. Amongst other contrivances for window ventilation may be mentioned the following:—(1) By substituting a glass louvre for the top centre pane; (2) by having some of the panes doubled, the outer with an open space at the lower edges, and the inner with an open space of the same size at their upper edges; (3) by having some of the panes made of perforated glass, as in Pott's plan; (4) by having a pane, or part of a pane, to open or shut by a spring arrangement, as in Boyle's Ventilator; (5) by fixing a fine wire screen to the top of the window, which unfolds when the window is pulled down, and folds up when the window is shut.

Additional ventilation can be further secured by having an opening over the door, into which a wire gauze screen could be fixed; or by having an opening in the outside wall near the ceiling, which could be provided with what is called a Sherringham Valve; or some other simple contrivance, so as to direct the entering current of air towards the ceiling. This upward direction of the entering current can also be secured by inserting one or more tubes, as in the system of ventilation introduced by Mr. Tobin, of Leeds, and Messrs. Shillito and Shorland, of Manchester. But where cheapness is a desideratum, the ventilation of any room in a poor man's house may be greatly improved when required by making a slanting

opening in the wall, at a point as far as possible from the fireplace, and about two feet from the ceiling—the opening, of course, to slope inwards and upwards, and to be about twenty-four inches in transverse area. Perforated bricks or wire-gauze might be used to divide the current, and a slide should be provided to close the opening, partly or wholly, when the wind blows directly against it.

But, unfortunately, all these, and other expedients which could be as readily adopted, are either neglected because the necessity for ventilation is not appreciated, or because warmth in many of the houses of the poor can only be secured by excluding the fresh outside air as much as possible. Another important condition for good bedroom ventilation is to keep the windows widely open during the early part of the day, and well air the bedding and bed-clothes. No matter how capacious and clean a bedroom may be, this important duty should never be neglected, and cleanliness and freedom from stuffiness will be all the more readily secured, if, instead of carpeting over the whole floor, only loose pieces be laid down, which can be easily lifted and shaken, and which permit of the floor being kept well scrubbed and dried, or bees-waxed and dry-rubbed.

With regard to the ventilation of the other rooms in a house, it is very essential that, by means of doors and windows on both sides of the house, there should be full facility given for what is called through or cross ventilation. The great evil of back-to-back houses depends upon the fact that this cross-ventilation becomes impossible, and the air of the house can never be thoroughly swept out; whereas, if there are openings on both sides, and the rooms freely communicate with each other by doors and passages, the natural movement of the outer air will act as a powerful means of ventilation, by sweeping out the foul air along with it as it passes through the house. At

the same time, it is necessary to guard against unpleasant draughts, and these may be prevented by adopting one or other of the various expedients which have already been mentioned, and more particularly the ventilating tubes of Tobin, or Shillito and Shorland. These tubes ought to be situated away from the fireplace, and should be made to pierce the wall horizontally about two or three feet from the floor. They are then diverted upwards along the inner surface of the wall, to within about the same distance from the ceiling, so that the entering air is made to impinge against the ceiling, and is thus distributed gently throughout the room without creating unpleasant draughts. The tubes themselves may be concealed by various devices, or, if desired, they can be ornamented in such a way as will, at least, not detract from the elegant appearance of a room. This system is well adapted for schools, churches, and public buildings.

When, however, a system of ventilation is adopted for the hall as already recommended in the section on structural details, the difficulties of ventilating all the rooms in the house which open on the staircase and landings are greatly lessened. A good ventilating stove, or hot water pipes, will supply the staircase and passages with pure warm air, which can easily be let into the several rooms by openings in doors or walls concealed by pictures or other devices.

In living rooms the chief outlet or extraction flue for the foul air is the chimney, and when a fire is kept burning, the volume of air constantly passing through the room and up the chimney would be amply sufficient in the great majority of instances for the purposes of health, if the air in the room were only kept properly mixed. But usually a large portion of the air enters beneath the door when the door is closed, and is drawn along the floor towards the fireplace, so that a great portion of it rushes

up the chimney without mixing with the contained air at all. It has also to be pointed out that with no outlets near the ceiling the air warmed by the radiation of the fire, by respiration, and by gas-lights, and which is full of impurities, is kept moving sluggishly about the top of the room furthest from the fireplace, until it becomes cooler and gradually sinks and mingles with a portion of the air entering beneath the door or through chinks and crannies in window-frames. Thus, in most rooms it is found that the upper layers of air are disagreeably warm and surcharged with the impurities of respiration and combustion, while the lower currents rushing towards the fireplace, are often extremely cold, and chill the feet and legs. On the other hand, if doors and windows are made to fit too tightly, and there are no other special inlets for fresh air, the chimney is certain to be a smoky chimney because of the down draughts which are produced to feed the fire. Much of all this can be prevented by providing special inlets near the ceiling, as already indicated, but away from the fireplace, and by inserting either an Arnott's or Crossley's Ventilator into the breast of the chimney and close to the ceiling, if no special extraction flue was constructed when the house was first built.

But to prevent discomfort arising from draughts of cold air, the greatest improvement which has been made in the warming and ventilation of rooms of late years, is the introduction of what are called ventilating grates. These are so constructed that a great portion of the fresh air entering a room is first warmed in a chamber behind the grate, which communicates by a special tube or channel with the air outside. They are not much more expensive than ordinary grates, and apart from their advantages from a sanitary point of view, they will I have no doubt come into general use at no distant date, on account of the great saving in fuel which they ensure. These grates

were first devised by Captain Douglas Galton, more especially for the warming and ventilation of military barracks; but they are now manufactured by different makers and of various patterns to suit every kind of room. Besides the Galton Grate, the ventilating grates of Shorland, Boyle, and Whitwell are all worthy of commendation, and the best argument in their favor is that, unless provision is made for warming the fresh air, the inmates of houses with limited cubic space will seldom permit effective ventilation, but will rather be inclined for the sake of personal comfort to stop up inlets.

The great majority of ordinary grates do not project far enough into the room, are placed a little too high, and having an open grating at the bottom, they consume large quantities of fuel without imparting anything like a proportionate amount of heat. Polished metal or ornamental glazed tiles make good radiating surfaces, but the lining in immediate contact with the fuel should be made of fire-brick because it ensures more perfect combustion, and the fire itself should rest on a slab of the same material. The grate known as the "Country Parson Grate," manufactured at Norwich, and the "Abbotsford Grate," are good examples of grates of this description. On the same principle, a considerable saving of fuel may be effected by placing a fire-clay brick of proper size in the bottom of any ordinary grate.

A very cheap and improved fresh-air cottage grate has been devised by Mr. Penfold, of London. It is made of well-burnt fire-clay with a chamber at the back as in Galton's grate, in which the fresh air can be heated, and arrangements can also be made for supplying the warmed air to the bedrooms above. Indeed, by adopting ventilating grates in the first construction of a house, and providing the necessary flues and openings, there would be no difficulty in warming all the rooms

in the upper stories by means of the grates in the rooms beneath.

Another plan for warming bedrooms which has lately come into more general use, is to lay a sufficient quantity of asbestos in the grate, and render it incandescent by two or three gas-flames arranged underneath. This plan possesses the advantages of cleanliness, freedom from trouble, and adaptability. It need hardly be said, however; that gas-warming, as usually carried out in shops by stoves without chimneys, is very unhealthy.

We now pass on to consider very briefly the subject of lighting. And first, it should be said that every room in a house should be illuminated from the external air, and not by means of light borrowed from another apartment; and, further, that all windows should be sufficiently large, and, of course, made to open. As regards artificial light, gas, though it generates more heat and uses up more oxygen than any variety of lamps or candles, is cheapest and most convenient, and is therefore generally consumed where it can be obtained. But, inasmuch as all ordinary gas-burners consume from three to four cubic feet of gas per hour, and as one cubic foot destroys the oxygen of eight cubic feet of air in combustion, and produces about two cubic feet of carbonic acid and other impurities, it is evident that the impurity of the contained air will be greatly increased, unless some special means are provided to carry off the products of combustion. In theatres and other large public buildings, extraction shafts above the chandeliers are generally provided to remove the vitiated air, and what is known as the "sun-burner" acts very efficiently in this way. Ricket's Ventilating Globe-lights, and those made by Benham, and Strode & Co., are also constructed on this principle. They are so arranged that so soon as the gas is lighted, an upward current is produced in the main tube, and as this becomes

heated, the air in the surrounding tube becomes rarefied and set in motion. In this way the heated air in both tubes is carried to a special shaft or to the chimney, thereby securing the removal of the products of combustion and a steady current outwards of the vitiated air in the room. Tubes of zinc or tin placed over common burners, and communicating with the external air or leading into the chimney, would answer the same purpose where ornamentation can be dispensed with. In the new infirmary at Edinburgh, every gas-jet is armed with an inverted funnel terminating in a pipe, which passes to foul air flues, in the walls. In the great majority of houses, however, no special arrangements of this description are provided, but much might be done to improve the ventilation and remove impurities by inserting, as already recommended, an Arnott's or Crossley's Ventilator into the chimney-flue near the ceiling, or by inserting what is called a ventilating ceiling flower over the gaselier, to communicate with a pipe or extraction flue. But without entering into further details, it may be said generally that the principles of ventilation by gas-lights are for the most part so easy of application, and the advantages to be gained are so manifest as regards health, that it is surprising they should still be so greatly neglected.

The introduction of the electric light into large public buildings, manufactories, workshops, and the like, will no doubt obviate many of the disadvantages attending gas combustion; but it is very doubtful whether it will speedily come into general use for the lighting of private houses.

To determine whether the air in a room is sufficiently pure or not, enter it after being in the open air for some time. If the room smells fusty or close, it is either overcrowded, badly ventilated, or there is some dirty condition of the walls or floors, some escape of sewer air, or

some smell from dry rot or a dead rat under the boards or behind the skirting. In any case, the cause ought to be discovered and removed or remedied.

As regards impurities from overcrowding or defective ventilation, Dr. Angus Smith has proposed a very convenient test which is as follows:—Take an eight-ounce glass-stoppered bottle filled with the air of the room and put into it half an ounce of lime-water:—if the lime-water shows no milkiness or precipitate after shaking, there is no detrimental excess of lung impurities; but if the lime-water becomes milky, then either the ventilation is defective or there is overcrowding.

VI. Outside Premises.

After the details which have already been given in respect to drainage, water supply, and closet accommodation, but little need be added concerning the surroundings of the dwelling, except that tidiness and cleanliness should, as far as possible, be maintained everywhere. Paths should be well laid or paved, and all yards should be evenly laid with some non-absorbent material, such as blue brick, cement, or asphalt. Paths or yards with an uneven and loose surface are always dusty in dry weather, and become so muddy when it is wet that it is next to impossible to keep floors clean. A dust-bin, ash-pit, or some other receptacle is required for the storage of ashes and dry house refuse, and precautions should be taken to prevent it from becoming a source of nuisance. In crowded localities it is preferable to use a small receptacle which can be placed outside the door of each house, and emptied regularly by the dustman each morning, but in most cases a dust-bin has been constructed. This should be situated at some little distance from the house and not under any window. It should not be below the level of the ground or basement, should be covered in to keep out wet, no slops of any kind

should be thrown into it, and it should be emptied regularly and at frequent intervals. Deep ash-pits are always more or less a source of nuisance because they not only permit of large accumulations, but in most cases the water in the surrounding soil drains into them. They should, therefore, be filled up to the level of the ground and have a paved or cemented bottom. No ash-pit should be connected with a drain, because the dust will speedily choke it up. Every outside closet, as already explained, unless it be a properly constructed water-closet, should either be a dry or ash closet provided with a box or pail to prevent nuisance, and necessitate frequent scavenging.

With regard to the keeping of animals, it may be laid down as a rule that pig-styes, fowl-pens, or cow-sheds should be absolutely prohibited in crowded localities; and even as regards isolated houses, the pig-stye should be at a safe distance from the house, and be well kept and properly drained. Heaps of manure of any kind should not be allowed to accumulate near dwellings, nor any collection of matter, solid or liquid, which is likely to taint the surrounding air.

VII. Hints about Choosing a House.

In choosing a dwelling, it very often happens that questions of convenience and other considerations which need not be discussed here, receive far more attention than questions of health. Indeed, the great majority of householders, whether through ignorance or indifference, trouble themselves very little concerning sanitary details, provided the homes which they are about to enter suit them in other respects; and it is not surprising, therefore, that many of them have to pay a heavy penalty in family sickness, which a little forethought and inquiry might have prevented. Of course, it is very difficult to lay down rules which would apply to all alike, but there are certain de-

tails which are of such general application that a few hints concerning them may, it is hoped, prove serviceable to most people. And, first, I would strongly recommend all those who can afford it to avail themselves of the aid of skilled advice to help them in the choice of a dwelling, or, if they have purchased or taken a house, to have it thoroughly examined before they enter it. There are so many defects which can be easily remedied beforehand, and often at little cost, but which if overlooked in the first instance, always entail discomfort in subsequent alterations, to say nothing of the risks to health which are sure to be incurred.

But even without the aid of skilled advice, an intelligent householder may satisfy himself concerning the sanitary arrangements of his intended home, if he has made himself acquainted with such details and requirements as have already been submitted in previous parts of this chapter. And the main questions which he should ask himself are these:—Is the situation suitable and airy? Is the subsoil dry? Are the walls dry? Are the rooms sufficiently commodious and well ventilated? Are the premises generally clean and in good repair? Is the drainage satisfactory? Is the water supply sufficient and good? There are vast numbers, of course, who cannot secure these conditions, even though they may fully appreciate their value, but they ought always to influence them as much as possible, and, where necessity rather than choice has determined the dwelling, an appeal should be made to the sanitary inspector of the district, if the landlord turns a deaf ear to the plea for necessary alterations and the removal of serious defects.

If possible, a house should always be chosen which has plenty of free space round it; and if, for other reasons, the dwelling must be selected in a crowded locality, preference should always be given to one with increased indoor space,

which is well lighted, well ventilated, and otherwise clean and in good repair.

In country districts, the laborer should avoid a cottage which is built against a slope, or one which has clay or brick floors. In the former case, the walls are almost certain to be moist; and in the latter, the flooring is always more or less damp—so that in either case there is serious risk of rheumatism, lung disease, or some other disorder. Floors, even in cottages, should always be laid with wood, with a free ventilated space under the boards, and the foundations, as already pointed out, ought to be covered over with concrete or asphalt. Moreover, the subsoil should be drained, and there should always be a dry area, either open or filled with rubble, between the walls and sloping ground. Then see that the roof does not let in the wet; that the walls are dry and clean, and not covered with layers of paper; that doors and windows are in good repair; that every window is made to open; and that the floors are in good order.

If the water supply is derived from a well, see that there is no deep cess-pit, ash-pit, pig-wash cistern, or manure-heap near it, and that any passing drain runs freely. Should the well not have been used for some time, it should always be pumped out before the water is used, and if possible, the well itself should be opened, examined, and cleaned out; and if there is still reason to suspect the water, a sample should be submitted for analysis.

In towns where the water supply is public, examine the cisterns and have them cleansed. See that the same cistern which supplies the closet does not supply the drinking-water, and that the overflow-pipe from the drinking-water cistern is disconnected, and does not enter directly into any soil-pipe or drain.

With regard to drainage, unfortunately, there is not the same possibility of examining with such a degree of

minuteness, because the drains are all concealed, and very often are laid in unsuspected quarters. Whenever it can be obtained, the intending tenant ought to insist on being supplied with a plan of the drainage; and if the house is old, he should not rest satisfied unless the ground is broken up, the drains opened, and any defects as regards construction, ventilation, disconnection, and trapping, made good. Rats in a house are almost a certain indication that the drainage is defective, and that there are free openings somewhere. Make special search after any hidden cesspool about the foundations, and if the house is an old country house, look out for huge brick culverts and sewage catch-pits under the walls. In new houses, see that water-closets, if not situated as previously recommended, abut against outside walls, that soil-pipes are exposed, in good order, and properly ventilated; that the closets themselves are well flushed; that the drains are also ventilated and trapped; and that all sink-pipes, and overflow-pipes from cisterns, baths, and lavatories, are carried outside and disconnected.

A very good plan to discover, or at least assist in discovering, whether the air of the house is pure and uncontaminated by sewage or other effluvia, and that the rooms, and especially those on the basement or ground floor, are well ventilated, is to have good fires lighted in all the rooms, and at the same time to have all doors and windows closed. After a sufficient interval when the fires begin to die out, the rooms should be entered one by one—first those on the basement or ground floor, and afterwards those in the upper stories. If there is any escape of sewage gas from drains, or any foul smell from dry rot or dead rats, the disagreeable odour will in all likelihood be detected, and steps should at once be taken to discover the cause. Examine and see whether the free space under the ground flooring is adequately ventilated by perforated

bricks or otherwise, and do not overlook the cellar-drains. These should always be properly trapped and ventilated outside, or disconnected, as already recommended. By having fires lighted in all the rooms, it will further be made tolerably evident whether the chimney-flues are all clear, and whether any of them are smoky or not.

To enter into further details would be merely a repetition of what has already been said, and indeed most of the hints which have been here summarized have previously been more or less fully treated; but as so much depends upon healthiness of the home, there can hardly be too much insistence on sanitary essentials. Although it is quite true that the business of life and other considerations compel most people to live in a particular locality, and to take things pretty much as they find them, still there can be as little doubt that every householder, in his private and public capacity, can do a great deal to influence his own health and that of his neighbors in endeavoring to improve and maintain the sanitary condition of his home and its surroundings.

VIII. Nuisances and Sanitary Defects Removable under the Sanitary Acts.

It is an old saying that an Englishman's home is his castle; and, accordingly, there are many people who foolishly resent the visits of sanitary officials as unwarranted intrusions into the sanctity of their domains. Those, however, who resent such visits are generally not tenants, or, if they are tenants, they are conscious that they are fostering some nuisance on the premises which is contrary to the provisions of the Public Health Act, and which the law can compel them to remove. Generally speaking, those who are most indignant at such visits are owners of the houses in which they live, and who naturally believe that, if they themselves are satisfied with the

sanitary conditions, no one else has any right to interfere. But the law pays no respect to persons, and it matters not whether the tenant is owner or not, the sanitary inspector, or inspector of nuisances as he is called, can give notice to remove any nuisance on the premises, or to remedy any defect which is injurious to health, and, failing compliance, the owner, agent, or tenant, as the case may be, can be summoned before a bench of magistrates, and an order obtained to have the nuisance removed, or the defect remedied, on penalty of a fine and payment of costs.

The nature of the nuisance or defect is described on the printed form of notice which is served by the inspector, and the requisite steps to be taken to remove the same are generally indicated, as well as a certain time stipulated in which the notice shall be complied with. In the case of nuisances or defects which require structural alterations, the law holds the owner or his agent responsible, no matter what private agreement may have been entered into between the owner and tenant; but where no structural alterations are required, the notice is generally served on the occupier. There is, however, one important exception, and it is this:—In the crowded localities of our large towns, and in country districts, the tenants of small houses, tenements, or lodgings, are usually weekly tenants, and it is impossible to keep the houses clean and properly limewashed unless the responsibility of this important requirement devolves upon the landlord or his agent. The law, therefore, gives power to every Sanitary Authority to compel the owners or agents of such premises to cleanse and whitewash whenever it is certified, by the medical officer of health or two properly qualified medical practitioners, that the premises, for want of proper cleanliness, are a nuisance injurious to health. In other cases, the notice to cleanse and whitewash may be served on the occupier, and this should be done in all cases when the

occupier can reasonably be held responsible to attend to this duty. Among other nuisances for which the occupier is responsible are the following:—The keeping of pigs or other animals in any place or in such a way as to be injurious to health; accumulations of manure; foul cess-pits, ash-pits, or closets; the storage of any liquid filth; and overcrowding.

On the other hand, the defects or nuisances for which landlords or their agents are held responsible may be summarized as follows:—Damp foundations; damp walls; roofs which let in the wet; uneven or broken floors; windows not made to open; walls in bad repair; insufficient or defective closet-accommodation; defective or badly ventilated drains; cesspools or cess-pits improperly situated or constructed; deep ash-pits; defects with regard to water-pipes or cisterns; insufficient water supply; and polluted wells. If premises are situated within a distance of a hundred feet from any public sewer or any public water-main, the Sanitary Authority can compel the owner to drain into the sewer, remove any cesspool, lay on water to closets, and lay on water generally to the house. Any house so unwholesome or in such a dilapidated condition as to be unfit for human habitation, can be closed by the Sanitary Authority of the district, on a certificate from the medical officer of health. It has only to be added that the Sanitary Authorities are—in the Metropolis, the Corporation of the City of London, and the Vestries; in provincial towns, the Corporations or Local Boards; and in rural districts, the Boards of Guardians, or Sanitary Committees appointed by them.*

It will be seen from these brief hints, that full power is given to insist on healthy dwellings and wholesome sur-

* This long list of unwholesome conditions which the English sanitary authorities have power to modify and abate, shows how thoroughly the riper civilization of Great Britain realizes that "Public Health is Public Wealth."—(R.)

roundings; and though it is far from my intention to encourage any feeling of hostility between tenant and landlord, I would again point out that the tenant, who finds his landlord deaf to any request made in respect to necessary repairs or alterations which he himself is not bound to attend to, can always appeal to the Sanitary Authority of the district or their inspector. It need hardly be said, too, that when repairs and alterations are carried out, especially in connection with the drainage, the workmen should be carefully looked after in order to ensure that the work is properly executed in all its details.

No doubt the difficulties of providing healthy homes, especially for the artisan and the laboring classes, are enormous, but earnest strivings are now being made in many directions, and, with the intelligent co-operation of the people themselves, we can hopefully look forward to a steady reduction of the death-rate, a gradual abatement of preventable suffering, and a progressive development of the national physique, and of every influence which tends to improve the public health, and promote human happiness.

CHAPTER VIII.

INFECTIOUS DISEASES AND THEIR PREVENTION.

In the brief historical sketch of the homes and habits of our forefathers, which has been given in the previous chapter, it was made sufficiently clear that conditions inimical to health were abundant everywhere. The wretched huts huddled together in walled-in cities were highly favorable to overcrowding and stagnant air; the scattered hovels on wild marshy wastes fostered ague and other malarial disorders; while the filth, which was everywhere allowed to accumulate in and around dwellings, polluted air and water alike, and was thus a constant source of pestilential diseases of the most virulent kind. Add to all this that the large armies, which were continually marching from place to place, conduced greatly to the spread of the infectious diseases thus bred and reared in filth, and it need cause no matter for surprise that fevers and devastating epidemics prevailed to a terrible extent for centuries. Thus, according to Dr. Guy, there were fifteen widespread epidemics and many famines during the twelfth century; twenty epidemics and nineteen famines during the thirteenth century; and eight epidemics and more famines during the early part of the fourteenth century. And these epidemics, it should be remembered, were not mere local outbreaks appearing only here and there with terrible severity, but they spread so far and wide, and entailed such a frightful mortality, that each and all of them were regarded as visitations of national disaster.

But the first most notable epidemic in our mediæval history was the Black Death, or Great Mortality, as it was called, which appeared in England in the year 1348. It was no doubt an aggravated form of the Oriental Plague, which was then devastating Europe as it had devastated the East. It was an eminently infectious disease, imported, in all likelihood, in the first instance, but when once it gained a footing on our shores, it spread with such terrible rapidity that within a few months almost every town and village throughout the country had been attacked, and in some places only a fourth part of the inhabitants were left alive. Imagination fails to realize the misery and horrors of the time; the sick died untended, corpses lay unburied or were flung in heaps into yawning trenches—everywhere there was terror and black despair. In London alone 100,000 fell victims to the disease, while throughout Europe it has been estimated that 25,000,000, or a fourth part of the entire population, were swept away.

Not to notice other epidemics which followed the epoch of the Black Death, the next great pestilence which ravaged the country broke out in 1485, and was known as the Sweating Disease. Unlike the Black Death and the Oriental Plague, which reappeared in the sixteenth and seventeenth centuries, it did not originate in a foreign country, to be conveyed by infection to our own shores, but it sprang into existence in this, and was no doubt generated and propagated by the foul insanitary conditions of dwellings and towns, and the filthy and intemperate habits of the people. During the latter part of the fifteenth century and the first half of the sixteenth, this pestilence reappeared no less than five times, its last visitation having occurred in 1551. But during all these centuries, sanitary progress was slow, tentative, and tedious. Indeed, it may be said that it was not until the

Plague, which was the next great pestilence after the Sweating Sickness, had repeatedly devastated the country, and the Great Fire, which swept away the crowded and filthy houses of London in 1666, occurred, that people began to appreciate, though in a faint and glimmering way, the principles of prevention. The Plague died out with the Fire; but small-pox, typhus or jail fever, malignant sore throat, ague, scurvy, and other controllable diseases still continued to contribute to the excessive mortality of the seventeenth century.

By-and-by, however, there appeared tangible signs of improvement. Food was becoming more plentiful, the diet less coarse, and the comforts of life began steadily to increase. The people themselves were beginning to appreciate more fully the advantages of cleanliness of person and of home; in short, the gradual emancipation from the thraldom of filth had commenced, and precautionary measures of a rough-and-ready kind were here and there attempted. Hence we find that at the beginning of the eighteenth century, three terrible scourges, namely, the Black Death, the Sweating Sickness, and the Plague, had finally disappeared from the bills of mortality, but it was not till towards the close of that century, that the physical causes of disease began to receive fuller investigation, and that consequently any conscious or well-sustained efforts were exercised in the way of prevention. And foremost amongst these pioneers of sanitary science must be mentioned the honored names of Captain Cook, John Howard, and the immortal Dr. Jenner. Captain Cook's name was associated with the suppression of that terrible disease, scurvy, which before his time had decimated our armies and fleets, and had often proved terribly fatal among the civil population. It is a disease which, no doubt, was fostered, as many other diseases are, by insanitary conditions; but its real cause is a diet from which

vegetables and fruits have been excluded, and therefore its prevention or cure depends upon a proper supply of vegetable food or vegetable juices. It is true that all this had been surmised long before the period in question, but it was reserved for Captain Cook, in his first voyage of discovery round the world, from 1772 to 1775, to prove beyond all dispute that the disease could be banished from every ship's crew, and that it could be entirely eradicated on sea and land. But the nation took years to learn the lesson which he was the first to illustrate and enforce, and many thousands more lives had to be sacrificed before it was rendered compulsory by law that lime-juice should form a part of the commissariat of every sea-going vessel. Scurvy, too, may now be reckoned among the diseases of the past, and if it occasionally reappears, it is solely through blamable neglect or some other mishap.

Passing over the self-sacrificing labors of the "great and good John Howard," which have already been alluded to in the previous chapter, it will suffice to say that the outcome of them all is simply this—that epidemic disease of any kind has long since been practically banished from within prison walls, and that such an improvement was commenced in the homes and habits of the people by John Howard's influence, that typhus, or jail fever, which was once so rife among us, soon began to decline, and is now only to be found in the dirty, impoverished slums of our large towns.

Before alluding to the next great sanitary triumph of the latter part of the eighteenth century, let us glance briefly at the progress made in the actual prevention of disease. We have just seen that the Black Death, the Sweating Sickness, and the Plague had finally disappeared towards the close of the seventeenth century; that the causes of scurvy and typhus fever had not only been fully investigated, but their prevalence had been largely lessened

even before the beginning of the present century; and that ague, which was once so common, especially in marshy districts, has practically been stamped out, owing mainly to improvements in drainage and drying of the subsoil. Diseases among infants and young children were much less fatal towards the close, than they were at the beginning, of the last century; the health of our soldiers and sailors was much better cared for, though up to the date of the Crimean war with its terrible lessons, it was still scandalously neglected; while, owing to improvements in house construction and ventilation, and greater general cleanliness, fevers of all kinds were becoming less plentiful. Altogether, therefore, the progress made in the actual prevention of disease was very considerable, and accordingly we find, as previously stated, that the annual mortality in the city of London, which amounted in round numbers to 80 per 1000 of the population during the seventeenth century, had been reduced to 50 per 1000 during the last century, and for years back it has averaged only 24 per 1000.

But infectious diseases still continued to contribute largely to the death-roll of the nation, and in 1833, 1848, and 1853, the country was visited by severe epidemics of cholera. These visitations, and the terrible evils which were fast accumulating from the rapid increase in the population, at last aroused Parliament to commence a long series of legislative enactments, which, though mostly of a permissive nature, were intended for the preservation of the public health and the prevention of disease. The first important Sanitary Act was the Public Health Act of 1848; but it was not till the Public Health Act of 1872 was passed that any approach to a system of sanitary supervision throughout the country generally was introduced; and this unfortunately still continues to be of a very imperfect kind in the great majority of sanitary dis-

tricts. Meanwhile the causes of preventable disease began to be investigated by inspectors appointed by the Government, with a precision and minuteness which have clearly and fully established not only the causes themselves, but the various intricate ways in which diseases of an infectious nature may be propagated, as well as the measures which are best calculated to suppress them.

I. Principal Zymotic Diseases.

The reader has already been supplied, in Chapter I., with statistics which illustrate the prevalence of these so-called zymotic diseases, and in Chapter III. their causes have been more or less fully explained; but in order that he may be the better enabled to assist in their prevention whenever he possibly can, it will be necessary to discuss each of the more important of them in detail. The diseases, then, which we have now to consider separately, and known as the seven principal zymotic diseases, are:—small-pox, measles, whooping-cough, scarlatina, diphtheria, fever (including typhus, typhoid, and relapsing fever), and diarrhœa. There are several other diseases of the zymotic class which are more or less infectious, such as cholera, erysipelas, pyæmia or blood poisoning, and puerperal fever which sometimes proves so terribly fatal at childbirth; but these are fortunately not so prevalent, and need not therefore require special notice. There has been no epidemic of cholera in this country since 1866, and there are strong grounds for believing that it has finally disappeared from amongst us. It was proved to be mainly propagated by impure water, and especially by water which became specifically tainted by the discharges of patients suffering from the disease. The precautionary measures which are indicated are, therefore, these—that in every case the discharges and any bedding or clothing imbued with them, should be carefully disinfected, and that special care should

be taken to prevent pollution of the water supply. The disease still prevails to a large extent in Eastern countries, and though there are widely divergent views to account for its dissemination, there is a constantly increasing amount of evidence which goes to prove that impure water and filth are the main elements in its propagation.

With regard to erysipelas and pyæmia, it may be said that they are essentially filth diseases, and they have often been known to spread with terrible fatality in the surgical wards of hospitals into which sewer air from defective drainage had found an entrance. When either disease occurs in isolated houses, it will generally be found to be due to similar insanitary conditions, or want of cleanliness of some kind. Puerperal fever, again, has often been communicated by the medical attendant or midwife from one patient to another; indeed, the risk of communicating the disease is so great that it is maintained by many in the profession that no medical practitioner should attend any cases of childbirth for three or four weeks after he has attended a case of the kind, and then only after taking the minutest precautions with regard to personal disinfection.

We now pass on to consider the mode of propagation of the principal zymotic diseases already named, and the precautionary measures which are indicated in respect to each. For practical purposes it is not essential that we should enter into any speculations with regard to their origin, except in so far as they can be traced to removable, local, or material causes. Some of them, such as small-pox, are only known to us as affections of the human body which, in case after case, multiply their respective types with a definiteness as precise as we see manifested in the highest orders of animal or vegetable life; in other words, the disease breeds so true that no fresh case is known to arise except by contagion or infection from some previ-

ously existing case. There are others, again, such as typhoid fever and diphtheria, which may be originated by filth in water, food, or air, but when so originated, propagate their kind with more or less definiteness from person to person, whenever local circumstances and other conditions favor their spread. But whatever their origin, or however much they may vary in infective power, they all thrive most vigorously in localities where overcrowding and want of cleanliness abound, and where ignorance, indifference, or culpable neglect permit their reckless dissemination.

1. *Small-pox.*—The third great sanitary triumph of the eighteenth century, already referred to, was, without doubt, the discovery of vaccination by Dr. Edward Jenner. That most hideous and loathsome disease, small-pox, had for centuries back been a terror and scourge to all classes of the community here and abroad, and, after the disappearance of the Plague, became the severest epidemic of the country. At what period it was first introduced into England history does not inform us, but, according to authentic records, it certainly existed both here and on the Continent prior to the ninth century, and there are notices of severe epidemics in this country from the twelfth century onwards. Dr. Guy, in his excellent work on "Public Health," states that it was entered on the London bills of mortality from 1629 to 1831, and that in the year 1796, when vaccination was first introduced, the deaths by small-pox alone exceeded 18 per cent. of the total number of deaths. To give some idea of its relative mortality, he further adds that during the last ten years of the past century, it was more than a hundred times as fatal as diarrhœa and allied diseases; seven times as fatal as measles; and six times as fatal as apoplexy, palsy, and sudden death taken together. It spared neither age, sex, nor position in life; every fifth

person attacked died; and many of those who survived were disfigured or maimed; indeed, it is estimated that nearly two-thirds of our blind population formerly owed the deprivation of their sight to this fell disease. As a rule, the disease, though never entirely absent, broke out in the epidemic form every third year, showing that it proved specially fatal among young children, and having sacrificed or attacked all those who were most susceptible, waited for a fresh crop of victims.

Now, against this loathsome and terribly fatal disease, there were discovered in course of time two protective processes or operations, namely, *Inoculation* and *Vaccination.* The method of inoculation was first introduced into this country at the instance of Lady Mary Wortley Montague, wife of the English Ambassador at Constantinople, somewhere about the year 1720. It was largely practised in the East during the residence of the ambassador and his sprightly wife at Constantinople, and in the year 1717 their son was inoculated there. But after it was introduced into England, it took many years before the practice became popular, and though there was no doubt that the mortality among persons who were inoculated was enormously lessened when compared with the mortality among those who had the natural form of the disease, there were some who believed that it greatly favored the spread of the disease itself.

In spite of this palliative, therefore—and no doubt it was a palliative—small-pox still continued to add largely to the death-rate up to the close of the century, so that any means which would act as a preventive would be longed for and welcomed by the profession and the public. Now, it so happened that Dr. Jenner, who was born in the year 1749, was apprenticed to a surgeon at Sodbury, near Bristol, and during his apprenticeship, as the story goes, a young woman came into the surgery, and chancing to

speak about small-pox and its dangers, said, "I cannot take the disease for I have had the cow-pox." This remark so coincided with the popular belief at the time, that it made a strong impression on the mind of the young student. He talked about it to his teacher, the celebrated John Hunter, and indeed, became so persistent in giving vent to the idea which was now beginning to take possession of his whole mind, that many of his friends voted him to be a bore. But Jenner stuck to his opinions, and after he settled in practice at the village of Berkeley, in Gloucestershire, he resolved to put them to the test. He had already stored his mind with all available information concerning the cow-pox and its protective influence on the milkers, and he forthwith commenced a long series of earnest and painstaking investigations. He first demonstrated the complete success of his discovery in 1796, and two years later published his researches in the form of a thin quarto of scarcely more than seventy pages. But in clinging to his first strong impressions, and in putting them to the test of experiment, he had to encounter an amount of bitter opposition and obloquy that might have well disheartened any one whose courage was not sustained by a holy reliance in the truth of his great discovery, and it redounds to his credit that he bore these trials with becoming equanimity. The honors and rewards came in slowly, but when they did come, and when the success of the operation had triumphed over all opposition, it was equally to his credit that his natural modesty remained unimpaired, and he continued unremitting in the discharge of his duties, and kind and attentive to the poor. In 1802 and 1807 he received grants from Parliament amounting to £30,000, and after living to see the triumph of his discovery, he died in the year 1823, at the age of seventy-four.

And now a few words with regard to vaccination itself.

The operation is simply the introduction into the human body, by a puncture or punctures in the skin, of that same matter which forms on the udder, or teat, of the cow, and which was long known to be transferred to the hands of the milkers. When Dr. Jenner began his investigations, cow-pox was more or less prevalent in Gloucestershire and other counties in the south of England, and he himself was led to believe that small-pox and cow-pox were in reality identical, but with this enormous difference as regards effects, that those who contracted the disease from the cow suffered but very little from constitutional disturbance, and had only slight local symptoms. Dr. Jenner's first inference, therefore, was this—that inasmuch as cow-pox was protective against small-pox, the disease could be produced by inserting the point of a lancet, charged with lymph from the vesicle on the teat of the cow, as readily and surely as when rubbed into the skin by the hand; and his second inference was—that if this operation was followed by certain local effects consisting of vesicles, the lymph from these vesicles would give rise to the same series of symptoms and local results, and so on, indefinitely, from person to person. "In a word," as Dr. Guy has forcibly put it, "it was assumed, and happily demonstrated, that just as small-pox had been made to pass from person to person by the inoculation of the matter from a small-pox vesicle or pustule, so cow-pox might be communicated from person to person by the same mode of procedure."

Such, in substance, was Dr. Jenner's great discovery, and such the method which he introduced, and though variously modified in minor details, it is the same method which still continues to be practised at the present day. It may further be of interest to the reader to note, in passing, that small-pox may be communicated to the cow, to the horse, to sheep, monkeys, and other animals, and

numerous interesting experiments of inoculating from one to the other have long since substantiated Dr. Jenner's views with regard to the identity of the infective material in all its manifestations. The great value of vaccination, then, is briefly this, that it gives rise only to local effects, with very slight constitutional disturbance, and if it does not afford absolute protection against small-pox, it greatly modifies the severity of the attack.

Let us now glance briefly at the results as borne out by statistics. But before doing so, it has to be pointed out that although vaccination was introduced in 1796, it made but very slow progress during several years; indeed, it is believed that in 1801 the total number of persons vaccinated did not exceed 6000; moreover, it did not become general till about the year 1819, nor can it be said to have entirely superseded the practice of inoculation till 1849. Now, according to Dr. Guy, the deaths from small-pox which occurred in London during the ten years ending 1799, amounted to 22,863 per 1,000,000 of inhabitants; during the ten years ending 1819, the number was reduced to 8045 per 1,000,000; and during the ten years ending 1849 the number was still further reduced to 4798. It therefore appears that, in round numbers, the death-rate had been lowered from nearly 23,000 per 1,000,000 inhabitants to a little over 8000 in twenty years, and to less than 5000 in thirty years more. But it has also to be borne in mind that there were no vaccination laws prior to 1840, in which year it was enacted that it should be gratuitously provided to the poor; and that compulsory vaccination was not enforced prior to 1853. Hence it is reasonable to infer that up to 1853 there were crowds of children who were not vaccinated at all, and it is well known too that of those who were vaccinated before and long after that date there were numbers on whom the operation was very imperfectly performed. Indeed, it is

only within the last fifteen years or so that the system of compulsory vaccination has been perfected, and all along it has met with no small amount of opposition from a very persistent minority. In spite of all these drawbacks, however, the death-rate from small-pox has, with slight variations, manifested a remarkable and progressive decline. Thus, if we return to the period when natural small-pox prevailed, we find that during the ten years ending 1770, the ratio of deaths from the disease compared with deaths from all causes was 108 per 1000 deaths, and that during the three subsequent decades of the last century, when inoculation became more general, the respective ratios were 98, 87, and 88 per 1000 deaths. During the first seven decades of the present century, that is, up to 1870, we find, on the other hand, that the ratios of deaths from small-pox to every 1000 deaths from all causes, were successively as follows:—64, 42, 32, 23, 16, 11, 11. These remarkable figures are alone sufficient to attest the protective value of vaccination; and if there are still recurrent outbreaks of the disease here and there throughout the country, it is because there are many now living who were never vaccinated at all, and many more who have been very imperfectly vaccinated. Then, too, it has to be conceded that though vaccination, when successfully performed, confers a practical immunity from small-pox on the great majority of people, it should be supplemented by re-vaccination about the age of twelve or fifteen to ensure complete protection. Nurses in small-pox hospitals, who have been re-vaccinated, are never known to contract the disease, and it is because medical men place such implicit reliance on vaccination and re-vaccination, that it is one of the rarest occurrences for any member of the profession to become infected, no matter how severe or numerous the cases which he may have to attend.

But even when vaccination does not afford complete protection, it so modifies the attack in the great majority of cases, that the disease runs a mild course, and there is no subsequent disfigurement. If well and thoroughly done, its influence extends throughout life, with but little loss of protective power; while, if imperfectly done, its protective power is never so efficient, and becomes less and less as life advances. On the other hand, the unvaccinated person is not only almost certain to contract the disease when exposed to infection, but statistics also prove that he is likely to take it in its most malignant form.

And now let us consider for a moment the principal preventive measures which are indicated by these well-established facts. The first, of course, is to ensure that the entire population are well and thoroughly vaccinated in infancy, and if it be asked, How do we know that a person has been well vaccinated? the answer is, By the size and character of the vaccination mark. It has happened over and over again in my own experience, when examining a patient suffering from small-pox, that no distinct mark of any kind was visible on the arm, even though assured that the operation had been performed during youth. In all probability, the operation had been performed, but in a very imperfect fashion. The aim of the operator should be to produce, either by separate punctures or otherwise, a mark on the child's arm at least the size of a shilling piece, and when done skilfully and rapidly, the operation cannot be said to be very painful. The second practical inference is this—that when small-pox appears in the household, or indeed in the neighborhood, every infant that has not yet been vaccinated should be vaccinated immediately, and every adult, and every child who does not possess a good vaccination mark, should be re-vaccinated. If these precautions are not taken, other

preventive measures will in all likelihood fail to prevent the spread of the disease.

I have dwelt at some considerable length on this subject, because there is no disguising the fact that there is a small band of well-meaning, and no doubt conscientious, men who are persistently agitating for the repeal of the compulsory Acts, and for the abolition of vaccination itself—their main arguments being that the operation is ineffectual, and that it is sometimes the means of imparting odious diseases and often impairs health. It is true the former of these objections must be admitted to a limited extent, but in face of the facts and figures already submitted, it is not an objection which can reasonably carry any weight. With regard to the latter objection, however, it cannot be denied that there have been instances, comparatively few though they are, in which vaccination has been followed by unfortunate results, not so much of a constitutional as of a local nature. Erysipelas is, no doubt, occasionally induced, very probably owing to want of proper care in keeping the lymph or lancet perfectly clean; but among the millions who have been vaccinated, the instances are so rare as to afford no well-grounded argument against the actual saving of life, and the protection from suffering and disfigurement which this inestimable boon has conferred on mankind. In all measures which concern the nation's health, it should not be forgotten that the Legislature has to consult the public good, even though cases of accidental hardship do occur. Meanwhile, it is worthy of notice that there is a movement now on foot which, it is to be hoped, will ultimately put an end to this disquieting agitation. It has been proposed by a few of the leading men in the profession that those who object to have their children vaccinated with human lymph, should be allowed to have the operation performed with lymph from the cow, and that the Government Department en-

trusted with the enforcement of the Vaccination Acts should afford facilities for the supply of such lymph. For my own part, I am inclined to think that this would be a judicious concession, for the simple reason that it would tend to allay fears which no doubt exist, and court acquiescence amongst those whose opposition has hitherto been most uncompromising, misleading, and mischievous.

We now pass on to consider very briefly the mode of propagation of the disease itself, and the precautionary measures which are indicated for its prevention. And first, it may be said that there is no infective poison or contagion which is so powerful and certain as that of small-pox, nor perhaps any which can operate for so long a distance. The infective particles may be wafted from house to house on opposite sides of the street, and no susceptible person can enter a house in which the disease exists, without running immense risk of being attacked. The poisonous material is thrown off from the skin, by the breath, and with the excretions, and is contained in the vesicles, pustules, and scabs which appear on the skin. It pervades the air of the sick-room, and attaches itself to all articles of bedding, clothing, drapery, or furniture contained in the room, while it is possessed of so much vitality that if protected from air, it may remain active for an unknown number of years. Generally, the period of incubation—that is, the period which intervenes between the date of infection and the appearance of the rash—varies from twelve to fourteen days; but no one coming from an infected district can be pronounced safe until about eighteen days have elapsed. The first symptoms are those of high fever, followed in three or four days by an eruption of pimples, which gradually become larger, and assume a peculiar oval shape, with a central depression. The eruption is generally at its height on the eighth day, when the vesicles, as they are called, begin to

suppurate, and after a time scabs are formed which begin to fall off about the fourteenth day. If the pimples, or vesicles, are solitary, with free untouched spaces round them, the disease is called *discrete*, or modified; but if they run into each other, it is called *confluent*. In some of the malignant forms of the disease, scarcely any eruption becomes apparent, the patient dying before it has had sufficient time to break out.

The course of the disease, whether the form be discrete or confluent, is divided into four periods, viz., the period of incubation, the feverish stage, the eruptive stage, and the suppurative stage. In all probability, the first and second periods are not (or but slightly) infectious, but the third and fourth are markedly so; indeed, a patient cannot be pronounced free from infection until all the crusts have fallen off, and the whole surface of the body has been well sponged with water and some disinfectant soap.

As regards the speedy suppression of this disease, it sometimes unfortunately happens that the first few cases, if of a mild nature, are mistaken for chicken-pox or measles by the medical attendant, because it is not always an easy matter to differentiate between the symptoms of these respective diseases. It is a wise rule, therefore, to take every precaution, even though the disease is not well pronounced; but when the case becomes clear, the best known means of prevention should at once be adopted. If the patient is not forthwith removed to a hospital, he should be carefully isolated; the person in attendance on him should, if possible, be one protected by a previous attack of small-pox or by re-vaccination; the other members of the household should be re-vaccinated in every instance in which the operation is indicated; and the same precautions ought to be adopted with regard to immediate neighbors. The other details concerning the management of the sick-room, disinfection, and the like,

will be more fully detailed in the rules which will be given further on to prevent the spread of infectious diseases generally.

2. *Measles.*—This disease is eminently communicable, and though essentially a disease of childhood, it often attacks persons of all ages. The period of incubation after infection varies generally from ten to fourteen days; then feverish symptoms set in, with running at the eyes and nose, and cough. The eruption appears in crops of a crimson rash, consisting of slightly elevated small dots, scarcely perceptible to the touch, and disposed very often in patches of a crescentic form. The febrile and catarrhal symptoms last about four days, the eruption six or seven days, and the whole duration of the disease is completed in nine or twelve days. So common is the disease in this country, that it is considered by many parents to be a natural and inevitable disorder of childhood; and at what they consider to be a favorable time of the year, they deliberately expose their children to infection, in order that they may take the disease and have done with it. It need hardly be said that so long as such a pernicious and fatalistic belief remains unrooted, precautionary measures will be of very little avail, and indeed, as regards this and the following disease, whooping-cough, the most culpable neglect and indifference still prevail even among people of whom better things might be expected, with regard to the expediency of adopting preventive steps of any kind. The poison, as in small-pox, adheres to clothing, bedding, and the walls and furniture of the sick-room, and infects the air, so that by that medium alone it can travel some distance. Isolation, disinfection, and prohibiting any children belonging to an infected house from attending school, are the precautionary measures indicated, but these will be more fully explained further on.

3. *Whooping-cough.*—The characteristic symptom of

this disease is a convulsive cough, followed by a long sonorous inspiration which is called the "whoop," or "kink." The period of incubation is doubtful, but it is believed that it averages five or six days. The premonitory symptoms are slight feverishness and catarrh, very much resembling those of a common cold, and, after the disease has fairly set in, it lasts from two to four weeks. The cough comes on in convulsive paroxysms, but during the intervals the patient is often comfortable, and looks as if nothing much were amiss. Like measles, the disease especially attacks young children, and it is so prevalent that very few escape. The infective material, which is believed to be of a volatile nature, is conveyed by the breath, and there can be no doubt that it adheres to articles of clothing. As regards prevention, strict isolation is the only measure of any value, and even this frequently fails to check the spread of the disease; while disinfectants of any kind are not known to be of much service.

4. *Scarlatina*, or *Scarlet Fever*, as it is often called, is a highly infectious disease, which specially attacks children between the third and fourth years, but after the fifth year the chances of attack decline rapidly. It is characterized by a scarlet efflorescence, or rash, which appears on the back of the throat and tonsils on the second day of the attack, then on the neck and face, and afterwards spreads over the whole body. The rash on the skin begins to decline from the fifth to the seventh day, and finally terminates in desquamation, or peeling off of the upper scales or layers of the skin. As a rule, the period which elapses between infection and the appearance of the eruption varies from four to six days, but in severe cases it may be much shorter. The infective material, like that of smallpox, is exceedingly powerful and volatile, so that no susceptible person can remain in the same room for any length of time, or even in the same house, unless the pa-

tient is carefully isolated, without running great risk of contracting the disease. Moreover, the infective material is contained in everything which proceeds from the patient, but more particularly in the cuticular scales given off in peeling. These scales, laden with the specific poison, are conveyed by the currents of air to every part of the room, and may settle on clothing, bedding, furniture, and the walls of the room. They preserve their infecting power for an unknown period of time, and may be conveyed long distances by articles of clothing and the like. There is reason to believe that the disease is infectious through the agency of the breath, even before the eruption appears; but, according to my own experience, it is seldom that other cases break out in the same family if the first case is promptly removed to a hospital and thorough measures of disinfection are carried out. The patient ought not to be pronounced free from infection until peeling has ceased, and the surface of the body has been well bathed.

There are three varieties of the disorder:—one in which the skin only is affected; one in which both skin and throat are affected; and one—known as malignant scarlatina—in which all the force of the disease seems to be expended on the throat. This last form of the disease is especially fatal; but, apart from these varieties, there are numerous cases to be met with in every outbreak, in which the only marked symptom is a slight sore throat, with no perceptible eruption on the skin. In the more severe forms, the tonsils inflame and become ulcerated, the glands of the neck become painful and enlarged, and in almost all there is congestion or acute inflammation of the kidneys which often induces dropsy.

There is reason to believe that the disease may be originated by sewer gases, foul effluvia from cesspools, and the effluvia given off by the decomposing blood from slaughter-

houses. But, however originated, or wherever a case appears, there is the greatest possible risk of the disease spreading if proper precautions are not immediately taken. As already pointed out in Chapter III., many severe outbreaks have been traced to the agency of milk when the disease has been found to exist in the dairyman's house. There is no doubt too that it is often spread by washerwomen who have children ill with the disease, and by sempstresses and tailors who are allowed to take their work to their own homes.

While general precautionary measures will be more fully detailed further on, I wish to point out here very forcibly that if the throat of the patient is carefully mopped out by some disinfectant, and the whole of the body anointed from day to day with carbolized or camphorated oil, alternating with baths when admissible until desquamation has ceased, the risk of other members of the household being attacked would be greatly diminished. Indeed, the late Dr. Budd, of Bristol, whose researches as regards this disease and typhoid fever are so well known, has put it on record that, by isolating the patient and carefully carrying out the above precautions, he always succeeded in preventing any spread of the disease in the same house. But these measures, of course, cannot be carried out except under the advice or sanction of the medical attendant.

5. *Diphtheria.*—Although it is sometimes very difficult to trace the precise origin and mode of propagation of this disease, there can be no doubt that it is intimately associated with sanitary defects, and it is not surprising, therefore, that it was numbered among fatal epidemics as far back as the sixteenth century. In the present day it is much rarer in this country than in former times, owing, no doubt, to steady sanitary progress; but there are still localized outbreaks, and these are of more frequent occur-

rence in rural than in urban districts. The disease is characterized by fever, often of a low type, and throat symptoms. The tonsils and back of the throat become inflamed, and after a day or two a gray patch of false membrane, as it is called, appears on one or both tonsils, and may extend over the whole back of the throat and down into the larynx, or windpipe. When the membrane especially exudes in the windpipe, the disease is often called croup, or diphtheritic croup. There can be no doubt, too, that where the disease is prevalent there are many cases to be met with which present the symptoms of simple sore throat. In severe cases, the disease often proves rapidly fatal, and in many recovery is slow at the best, the glands of the neck and the kidneys being often affected as in scarlatina.

As already pointed out in Chapter III., scattered cases can often be traced to polluted water, to sewer air, or to milk which has been contaminated with polluted water or tainted air. If a milkman has diphtheria in his house, or if any of the milkers happen to suffer from the disease, there are strong grounds for believing that the milk may become infected by the breath, and that the infection may readily be spread in this way. Although the disease is not so much confined to children as scarlatina, it is often propagated by the agency of schools, and in households by kissing. The infective particles given off by the breath are exceedingly powerful, and no one should on that account bend over or kiss the patient, while all expectorated matters, and rags used to wipe the nose and mouth, should be carefully disinfected or burned. Strict isolation is of course indicated, and, with the exception of the oil inunction, the same precautionary measures should be adopted as apply to scarlatina.

6. *Fever.* (*a.*) *Typhus Fever.*—This form of fever has been more or less epidemic from the earliest ages. Over

and over again it has decimated insanitary armies, invaded jails as in John Howard's days, and its ravages have always been greatest where overcrowding and famine have prevailed. Owing mainly to improved house accommodation and greater cleanliness, it rarely appears in this country in the present day, except in the dirty overcrowded parts of our large towns. It attacks persons of all ages and both sexes, and its onset is generally somewhat sudden, for the exact period of incubation is unknown. The disease is characterized by a mottled dusky eruption, which appears in the skin, generally from the third to the eighth day, and usually remains visible for eleven or twelve days. The febrile symptoms are mostly of a low type—languor and weariness are prominent from the first, often passing into sluggishness of intellect, muttering delirium, and complete prostration. In cases of recovery, the average duration of the disease is about twenty-one days, but in mild cases convalescence may be favorably advanced from the thirteenth to the seventeenth day. When the disease proves fatal, death takes place generally between the twelfth and twentieth day.

The conditions favorable to the propagation of typhus fever are mainly these:—overcrowding and deficient ventilation, want of personal cleanliness, squalor and want, a deteriorated state of the constitution from whatever causes, and a moderate temperature. The disease, once generated, is highly infectious, the poison being thrown off by the exhalations from the lungs and skin. But the infective material does not travel far through the air, for it appears that if the patient is isolated in a well-ventilated room, the attendants incur little risk, and the other members of the household none whatever, so long as they avoid close contact with the patient or his infected belongings. The vast majority of cases of this and other infectious diseases, however, occur in houses where strict isolation is

impossible unless the patient is at once removed to a hospital. In addition to isolation, the other general precautionary measures which should be adopted are similar to those which apply to small-pox and scarlet fever.

(b.) *Relapsing Fever.*—This fever has become much less frequent during recent years than even typhus, and, though infectious in the same way, is not infectious to the same extent. It selects its victims from the poor and ill-fed, who are huddled together in crowded and badly ventilated dwellings, and it is liable to become epidemic in times of scarcity or famine. It is characterized by a very abrupt onset and short duration; but while the feverish attack lasts it is almost always severe, with a bounding pulse, headache, vomiting, and sometimes delirium. These symptoms generally terminate by free perspiration, between the fifth and eighth day, and after an interval during which the patient appears to be rapidly recovering, he sickens with a second attack, in all respects similar to the first, except that it is milder and shorter in duration. This relapse, as it is called, usually supervenes on the fourteenth day after the commencement of the attack, and it may be followed by a third or fourth relapse. There is no special rash, or skin eruption, to characterize the disease as in typhus fever.*

(c.) *Typhoid Fever.*—This fever is known under several names, such as enteric fever, gastric fever, low fever, and there is no doubt too that it is often registered as simple continued fever. Some writers maintain that genuine typhoid fever can only be propagated from a previously existing case or cases; but there is a constantly increasing amount of evidence which goes to prove that it is often

* The cause of Relapsing Fever is now almost positively proved to be a microscopic vegetable organism, which develops by millions in the blood of persons sick with the disease; and this fact, of course, encourages us to believe that similar causes of other contagious maladies may soon be discovered, and our means of avoiding or controlling their spread rendered thereby far more efficacious than heretofore.—(R.)

induced by sewer air, foul effluvia from cesspools, or polluted water, independently of any previous case. As it occurs in rural and small urban districts, my own experience leads me to believe that the great majority of scattered cases are originated apart altogether from the influence of specific germs; but, however induced or however propagated, it is essentially a filth disease, and when once developed, the bowel discharges, where local conditions assist, can operate with terrible force, and often at long distances from the sick. The outbreaks already referred to in Chapter III. show how readily the disease may be spread by milk which has become contaminated by polluted water, or how, if typhoid germs once find an entrance into a sewer or a public water-main, it may attack large numbers of people living in the same locality. The great preventives against typhoid fever, therefore, are these:—properly constructed, ventilated, and flushed sewers in towns; properly constructed, ventilated, and disconnected house-drains; a good public water supply, protected in all its details against the entrance of impurities; and thorough cleanliness everywhere. In country districts, again, the wells must be guarded against pollutions, leaky cess-pits or filthy closets abolished, and leaky drains repaired and kept clean. As regards other precautionary measures, it is of the utmost importance that all soiled clothing and discharges from the typhoid fever patient should be thoroughly disinfected, and that in country districts the excreta should always be buried in the garden, if possible, and not thrown into the outside closet.

The disease itself presents many and varied features, but it is mainly characterized by an eruption of rose-colored spots on the abdomen, which make their appearance from the fourth to the twelfth day after the feverish symptoms set in. These spots generally occur in crops, each spot remaining visible for about three days. In

many cases, however, the spots are ill defined or absent altogether, but in most there is tenderness over the abdomen, and after a time diarrhœa sets in, and the glands of the intestines become inflamed and in severe cases ulcerated. The average duration of the illness is about three weeks, and when it terminates fatally, death usually occurs towards the close of the third week. The period of incubation varies greatly, and sometimes may be protracted so long as twenty days; indeed, the fever sets in so insidiously that it is often difficult to fix the commencement of the attack, the patient suffering for days previously from languor, depression, loss of appetite, and general bodily discomfort.

7. *Diarrhœa.*—It is very doubtful whether this ailment ought to be fairly classed among zymotic diseases, inasmuch as among infants especially, it often results from bad feeding, and among grown-up persons, it is not uncommonly induced by errors of diet. There can be no question, however, that as previously stated, it is frequently originated by filth, whether from foul surroundings, sewer gas, or polluted water, and it no doubt prevails largely among the infant population, because the milk upon which they are fed is often diluted with impure water, and because feeding-bottles are not kept properly clean.

Having thus far considered in detail the principal zymotic diseases, a few words may now be added concerning channels of infection which are very liable to be overlooked or concealed. And first, it has to be pointed out that diseases such as scarlet fever, measles, and diphtheria, which especially attack young children, are almost invariably spread through the agency of schools. Not only are children from infected houses allowed by their parents to attend school so long as they are not prohibited by public officials or the medical attendant, but it often happens that children who are only affected to a slight extent with one or other of these diseases are permitted

to go to school as usual, and thus become certain and dangerous centres of infection. But apart from the disastrous results which depend upon the ignorance or reckless indifference of parents in this respect, there can be no doubt too that the agency of schools in the propagation of infectious diseases is becoming all the more potent as attendance becomes better enforced. Under the Education Act, teachers in elementary schools are paid by results and according to the average attendance, and as closing a school therefore entails a certain pecuniary loss, the teacher is naturally averse to report cases to the sanitary officials because he is afraid that it might be deemed necessary to close the school. He forgets the fact that if the first cases in an outbreak are isolated, and proper precautionary measures are adopted, the further spread of the disease may be checked; but these first cases are often concealed, or at all events not reported, and consequently the outbreak may assume serious dimensions before it is known to the Sanitary Authority or their officials.

I have often heard it urged by teachers and school managers, that it is of no use closing schools to check the further spread of infectious disease, because the children are sure to mingle and play together in the streets. But the conditions are altogether different. In the open streets there is far more free space, and there is little comparative risk of inhaling infection from the breath or clothes; whereas at schools the children's caps, bonnets, and overcoats are hung up together; the children themselves are packed so closely while in school that they must inhale each other's breaths, and have to run all the risks from personal contact; while the dangers are greatly increased by the condition of the outside offices, which, in country districts especially, are often of the foulest description and notoriously neglected.

Among other channels by which infectious disease is

frequently spread may be mentioned the occurrence of cases in small shops, or other places of business. Under such circumstances, an attempt is generally made to conceal any cases of the kind as long as possible, because the shopkeeper is afraid of losing his business and frightening his customers. Then, too, as already pointed out, there can be little doubt that infectious disease is often spread by tailors and sempstresses, who are allowed to stitch the garment of the fashionable wearer in their own miserable homes, with, perhaps, a sick child suffering from scarlet fever, small-pox, measles, or diphtheria, lying covered with rags in a corner of the same room. Indeed, in London and other large towns, there is very little of the actual work of fashionable tailoring or millinery establishments done on the premises; the large bulk of it is taken home by the work-people and finished there. But there are other channels of infectious communication which operate perhaps even more disastrously than these; and amongst them I may mention the following:—Pawn-shops, where articles of clothing from all parts are huddled and stored together; small laundries, which are scattered round the outskirts of towns; dairymen's premises, when they are not properly supervised and kept in good order; and lodging-houses in fashionable watering-places. Nor should I omit to refer to the terrible risks attending the custom of holding wakes, which still prevails to a large extent among the Irish poor. It matters not whether the patient may have died from small-pox, typhus fever, or some other dangerous infectious disease, the custom is still observed in spite of all remonstrance, and with a reckless indifference to danger which can only be accounted for by ignorance and superstition. But I have already said enough, and more than enough, to convince the reader how varied and intricate are the channels of infection, and how incomplete and imperfect are our sanitary de-

fences against them. People who live in clean and elegant homes away from the foul breeding-places of infectious diseases are too apt to forget how closely the dangers press upon themselves. Not only may their clothes be made in these pestiferous localities, but the message-boys, charwomen, postmen, servants, "the hewers of wood and drawers of water," who attend to their wants, either live in the overcrowded slums of our large towns, or have friends or relations whom they visit there. It thus appears that infectious diseases take advantage of almost every relationship of life. The infective material may be left in a cab, communicated in a railway carriage, or be actually inhaled from the breath or infected clothing of the person sitting next you in an omnibus or tramway car. Hence it follows that the prevention of infectious disease is a matter of public and national concern, irrespective altogether of private interests or personal considerations. But public measures, however well devised, can never prove effectual unless backed by earnest and intelligent private efforts; and we will now proceed to indicate how these may best be carried out.

II. Practical Disinfection.

Disinfectants may be described as agents which are intended to destroy the infective power of so-called disease-germs, or indeed of any decomposing matter, whether existing in air, water, or other substances, which tend to produce disease. Some of them act as deodorants by destroying offensive effluvia, or as antiseptics by arresting decomposition, or as destructives by their direct chemical action; and the most efficient amongst them are endowed with all these properties, though in varying degrees. It would be out of place here to weary the reader with a long list of the numerous substances which are recommended for purposes of disinfection, and I shall therefore

only mention a few of the agents which have been proved to be of undoubted value in this respect. These are—fire, or dry heat, sulphurous acid gas, sanitas, Condy's Fluid, chloralum, carbolic acid, feralum, and chloride of lime.

While extreme cold prevents putrefactive change, and therefore acts as an antiseptic, extreme heat is destructive of all organic matter, and is therefore the most efficacious, as it is the most ancient, of all disinfectants. But even a temperature much below that of actual combustion is found to be sufficiently powerful, if continued for any length of time, to kill animal or vegetable germs, and to render inert any infectious matter. But the temperature ought not to be below 240° Fahr., and care must be taken that this temperature is actually reached by every particle of matter included in the heated space. What are called disinfecting chambers are now provided in most large towns, and they are so arranged that this temperature can be maintained for any desired length of time, so that articles of clothing and bedding can be thoroughly disinfected in them and without injuring the material. In all localities, therefore, where such chambers have been provided, the householder should apply to the sanitary officials to have any articles disinfected which cannot be so efficiently purified by other means. In cases of malignant infectious disease, such as confluent small-pox, it is sometimes necessary to have the clothing or bedding destroyed by fire or disinfected and buried, but that is generally done by order of the medical officer of health.*

Sulphurous acid gas is the most convenient and efficient agent for disinfecting empty rooms after cases of infec-

* The thorough disinfection of contaminated clothing, bedding, &c., by hot air is performed under the authority of Boards of Health in some of our large cities, and we hope will soon become general in America.—(R.)

tious disease. The plan of procedure is as follows:—After recovery or death, the sick-room and its contents should be thoroughly fumigated by burning about a pound of lumps of sulphur in an iron or earthenware dish (or the lid of an iron saucepan), supported on a pair of tongs over a bucket of water. Before setting fire to the sulphur, the windows should be closed, and the fireplace or other crevices pasted over with thick paper, or otherwise made air-tight. The door should then be shut, and the room be kept closed for five or six hours. After which it should be freely ventilated, the paper, if any, removed, the walls and ceiling lime-washed, and the floor and furniture washed with disinfectant soap and water.

Disinfectants are not of much value to purify the air of the sick-room, but they are useful in removing unpleasant odors, provided they do not irritate the patient or disguise the signs of deficient ventilation. Chloride of lime or carbolic acid are not suitable for sprinkling about the room, because the odors given off by them are unpleasant; but sanitas or chloralum, or Condy's Fluid,* may be used with advantage. The discharges from the patient should be received in vessels containing either of these disinfectants or carbolic acid, and all bed or body linen should be received into a vessel containing water charged with sanitas, chloralum, or carbolic acid (about half a pint to two gallons of water), before removal from the room, and afterwards boiled. Condy's Fluid and chloride of lime are both unsuitable for this purpose, because the former stains, and the latter injures, articles of clothing. The medical attendant or sanitary official will generally give instructions as to what particular disinfectant to use, and

* Instead of purchasing this disinfectant in solution, it is better to prepare it when wanted, by dissolving one ounce of crystallized Permanganate of Potassa in a gallon of water.—(R.)

it is always advisable to employ one only, such as sanitas,* which can be used for all purposes.

III. General Precautionary Measures.

When a case of dangerous infectious disease occurs or is suspected, a medical practitioner should be immediately sent for. No suspected case should be taken to a dispensary or hospital for advice from any house where dangerous infectious disease exists.

If the patient is not removed without delay to a hospital for infectious disease, by advice of the medical attendant, he should, if possible, be separated from the rest of the family.

No householder or employer of labor can send servants suffering from dangerous infectious diseases to their own homes, without rendering themselves liable to be prosecuted by the Sanitary Authority of the district.

If the disease happens to be small-pox, any unvaccinated infant in the house should at once be vaccinated; and all adults or children with indistinct vaccine marks should be re-vaccinated.†

As a rule, a room at the top of the house makes the best sick-room, and this should at once be stripped of all carpets, curtains, or other needless draperies.

Persons in attendance on the sick should by preference wear cotton dresses, maintain scrupulous cleanliness, and should avoid, as far as possible, associating with others.

Disinfectants which have no unpleasant odor may be sprinkled about the room; but the best of all disinfectants for the air is free ventilation by open windows, and a fire if necessary.

* The carbolic acid solution above-mentioned is probably quite as efficient, and in some respects to be preferred.—(R.)

† It is safer to re-vaccinate every person living in a house where small-pox exists, or exposed to the disease, even those who have distinct vaccine marks.—(R.)

All discharges from the patient, especially if the disease is typhoid fever, small-pox, or scarlatina, should be received into vessels containing some suitable disinfectant, as recommended, and should be removed from the sick-room without delay. In country districts, it is advisable that they should be buried in a hole dug in the garden.*

Soft pieces of rag should be used for wiping the mouth and nose of the patient when deemed necessary, and these should either be burned, or plunged into some vessel containing a disinfectant, and removed without delay.

All bed or body linen which has been in contact with the person of the patient should be received into a vessel containing water charged with a disinfectant, before removal from the room, and afterwards boiled.

All glasses, cups, or other vessels used in the sick-room should be scrupulously cleaned before being used by others.

If the disease is scarlet fever, the body of the patient should be rubbed all over with camphorated oil daily, so soon as approved by the medical attendant, and when the patient is able to take a warm bath, the whole of the body should be well bathed with water and some disinfectant soap. With the approval of the medical attendant, these baths should be continued every alternate day until such time as he may consider the patient entirely free from the disease, after which, and in clean clothes, he may be allowed to rejoin the family and go out of doors, but not till then.†

If the disease happens to be small-pox, the patient cannot be pronounced free from the disease until all crusts or scabs have been removed and the whole body has been

* At least two hundred feet from any drinking-water well.—(R.)

† Washing with carbolic-acid soap (or other disinfectant) should be particularly thorough among the hair of the head, eyebrows, etc., where flakes of epithelial cells, in the form of dandruff, freighted with germs of contagious disease, are especially apt to linger.—(R.)

well bathed. Indeed, the patient should always be well bathed before putting on clean clothes, and especially if the disease is characterized by any eruption on the skin.

In case of death, the body should be enveloped in a sheet steeped and wrung out of some powerful disinfectant, such as carbolic acid, and buried without delay.

After recovery or death, the sick-room and its contents should be fumigated and disinfected, as previously directed.

Blankets, bedding, and woollen materials should either be sent to a public disinfectant chamber for disinfection, or they should be steeped in water charged with a disinfectant, and boiled, and afterwards kept exposed to the outside air for some considerable time. The hair of infected mattresses should be teased out, fumigated in the sick-room with sulphurous acid gas, and afterwards exposed to the air, if the mattresses cannot be disinfected in a hot air chamber.

All articles that cannot be properly disinfected should be burned, or buried in a hole dug in the ground, with disinfectants thrown over them.

No clothes should be sent from any house where there is fever or infectious disease, to be washed elsewhere; nor if clothes are received to wash, should they be received if a case of illness of the kind exists in the house.

The greatest care should be taken not to allow any children belonging to a house where there is fever or infectious disease to mix with other children, and the rest of the family should, as far as possible, avoid associating with others.

On no account should any child be sent to school from a house or family where fever or infectious disease exists.

The greatest care should be taken to remove all nuisances from the premises. No filth accumulations of any kind should be tolerated, and disinfectants should be freely

used for closets, whether inside or outside. Drains should be kept well flushed and disinfected. Above all, the water supply should be looked to if obtained from a private well.

Early information of every case of fever or infectious disease should be forwarded to the sanitary inspector of the district, who is generally authorized to order the supply of disinfectants to all who are too poor to buy them.

Although it may not be possible to carry out these precautions in all cases, it ought to be the duty of every responsible person to strive to do so.

Penalties.

By provisions of the Public Health Act, 1875, it is enacted as follows:—Any person suffering from any dangerous infectious disease, who willfully exposes himself in any public place or public conveyance, and any one in charge of such person, and any owner or driver of a public conveyance who does not immediately disinfect his conveyance after conveying an infected person; or any one who, without previous disinfection, gives, lends, sells, or transmits (to the wash or otherwise) any bedding, clothing, linen, or rags, which have been exposed to infection, or who lets any infected house or room, or who neglects to disinfect premises after due notice has been given, can be prosecuted by the Sanitary Authority, and is liable to heavy penalties.

Concluding Remarks.

Although it would be out of place to discuss here the public measures which are still required for the systematic control of preventable disease, it must be apparent to the reader that such control cannot be exercised with any approach to efficiency until the law makes it compulsory to register or report every case of dangerous infectious

disease to the local Sanitary Authority so soon as the nature of the case is determined. A few towns, such as Bolton, Dundee, Jarrow, and Nottingham, have already obtained local Acts, containing a clause or clauses compelling the householder to give such information on the certificate of the medical attendant; and it is to be hoped that at no distant date an Act will be passed to apply in this respect to all parts of the country. No doubt the passing of such an Act would be very distasteful to several classes of tradespeople, who believe that their interests would be seriously jeopardized; but it is often through the selfishness of these people and want of regard for the public safety that infectious disease is spread. I refer more particularly to that numerous class of small shopkeepers whose living-rooms are in direct communication with the shop, to lodging-house-keepers, hotel-keepers, dairymen, and washerwomen. Amongst all these and other classes who have intimate relations with the public, there is a conspicuous want of conscience in their dealings with respect to infectious disease. Concealment is their first resort, and this is generally backed by artifice and deceit so long as concealment is possible. Nor is this lack of conscientious fair dealing confined to tradespeople; there is an incredible amount of indifference apparent among all classes, and even among those from whom better things might be expected. For example, how often does it not happen that a domestic servant, who is believed to be suffering from fever or infectious disease, is at once sent off in the most secret way to her own home, where in all probability she cannot be properly nursed, and where she is almost sure to be the means of conveying infection not only to her relations but to next-door neighbors? Every case of dangerous infectious disease, therefore, ought to be regarded as a public danger, against which the public, as represented by local Sanitary Authorities,

are entitled to be warned by timely information; nor can there be any doubt that the proper person who ought to be made responsible for supplying such information is the householder, and that the medical attendant should be paid by the Sanitary Authority for the requisite certificate. It is for lack of such early information that outbreaks often assume serious dimensions before they become ascertained facts, and preventive measures become practically powerless to arrest their spread because the centres of infection have become so numerous and scattered.

But in addition to compulsory and early information of all cases of dangerous infectious disease, it is also requisite that adequate means for isolation should be provided for all cases which cannot be properly isolated and treated at their own homes. It is true that Sanitary Authorities are empowered by the Public Health Act to provide hospital accommodation, and to pay for the maintenance of poor patients out of the rates, but unless it be in large towns, the instances are as yet comparatively rare in which these powers have been exercised. But even in small villages or places where hospital accommodation may not be required, much good may be effected by adopting, as far as possible, a system of quarantine; by supplying skilled nurses when necessary; and by taking care that disinfection and other precautionary measures are duly carried out. In saying all this, however, it must not be forgotten that in arresting the spread of infectious disease, we must still rely in great measure on the active and intelligent co-operation of the people themselves, not only in improving and maintaining the sanitary condition of the home and its surroundings, but by endeavoring to the best of their ability to prevent others from suffering when their own family circle is attacked. There are many, too, who look hopefully forward to the vast benefits which would ultimately result if the relations

between the public and the medical profession were very much altered. Hitherto the prevailing practice has been not to apply for medical advice until after sickness has actually set in, but it is maintained by many, and with reason, that it would be a far wiser policy to pay the medical attendant a fixed sum quarterly or annually to look after the health of the household. This plan is adopted to a certain extent in club practice, dispensary work, and poor-law work; but as a rule all these appointments are very much underpaid because they are regarded as stepping-stones, so to speak, to general practice. But the practice of medicine is very different now to what it was in days gone by, for in its modern sense and work it is preventive as well as healing. Still, however, it must be said that the credulity of the public in the power of cure still reigns paramount, while their faith in prevention lies practically dormant, and hence it is that quackery of every description continues to thrive, and the pills and potions which are so largely advertised find a ready sale. Then, too, it has to be pointed out that so long as medical practitioners are paid solely for their services in attending on cases of illness, it is manifestly not to their interests, from a purely monetary point of view, to assist in the prevention of disease, because if prevention means anything at all, it certainly implies that the more effectually the causes of disease are removed and precautionary measures are carried out, the less numerous ought patients to become, and the sick-rate and death-rate will both be lowered. It is true that medical men, with the noble disinterestedness which characterizes the profession, are seldom lax in doing all they can to prevent the spread of disease; but there is no disguising the fact that in many quarters there is appearing on the surface a growing antagonism between medical practitioners and Sanitary Authorities, which is very much to be regretted. All this might be

obviated if the public could only be persuaded that it would be to their ultimate advantage to pay the medical attendant a liberal allowance to conserve the health of the household. He would then be in a position to warn them against many unsuspected causes of disease, whether personal, material, or local, and thus prevent many an illness, and at the same time foster the general health in many ways. This, however, is a question which the public must settle for themselves; and I have ventured to allude to it, by way of conclusion, to show how essential it is that, in addition to improved and extended sanitary legislation, aided and sustained by enlightened public opinion, the services of the profession generally should be enlisted in the grand policy of prevention.

INDEX.

F.

G.

H.

I.

J.

K.

L.

M.

THE END.

ELECTROTYPED BY MACKELLAR, SMITHS & JORDAN, PHILADELPHIA.

Catalogue No. 5.

A CATALOGUE

OF

General and Scientific Books

PUBLISHED BY

P. BLAKISTON, SON & CO.,

(SUCCESSORS TO LINDSAY & BLAKISTON)

Booksellers, Publishers and Importers of Medical and Scientific Books,

1012 WALNUT STREET, PHILADELPHIA.

INDEX OF SUBJECTS.

P. Blakiston, Son & Co.'s publications may be had through Booksellers in all the principal cities of the United States and Canada. Any book will be sent, postpaid, upon receipt of price, or will be forwarded by express, C. O. D., upon receiving a remittance of 25 per cent. of the amount ordered, to cover express charges. Money should be remitted by postal note, money order, registered letter, or bank draft.

Complete catalogues of Books on Medicine, Dentistry and The Collateral Sciences, sent upon application.

☞ All new books received as soon as published. Special facilities for importing books from England, Germany and France.

CHEMISTRY AND PHYSICS.

RICHTER'S INORGANIC AND ORGANIC CHEMISTRY.

Inorganic Chemistry, a Text-book for Students. By PROF. VICTOR VON RICHTER, University of Breslau. Authorized Translation from the Third German Edition, by EDGAR F. SMITH, M.A., PH.D., Prof. of Chemistry, Wittenberg College, formerly in the Laboratories of the University of Pennsylvania. With 89 Illustrations and a Colored Plate of Spectra. 12mo, 424 pages. Cloth, $2.00

From F. A. Genth, Prof. of Chemistry; F. A. Genth, Jr., Ass't Prof. of Chemistry, University of Pennsylvania.

"We have examined with much care the 'Inorganic Chemistry' of Prof. Victor von Richter, recently translated by Dr. E. F. Smith. Both theoretical and general chemistry are treated in such a clear and comprehensive manner that it has become one of the leading text-books for a University course in Germany. We are indebted to Dr. Smith for his translation of this excellent work, which may help to facilitate the study of chemistry in this country."

From Prof. B. Silliman, Yale College, New Haven, Conn.—"It is decidedly a good book, and in some respects the best manual we have."

From Prof. Sam'l S. Green, Swarthmore College, Penn'a.—"I am of the opinion that it is the best text-book of the kind I have seen. I shall recommend it to my classes."

From Prof. A. A. Bennett, Chicago University.—"I am satisfied this work is the best that I have yet seen, and that it will in a high degree fill the want."

From E. H. S. Bailey, University of Kansas, Lawrence.—"Dr Smith has, by his excellent translation, brought into prominence one of the best and most recent books upon the science of chemistry."

BY THE SAME AUTHOR AND TRANSLATOR.

ORGANIC CHEMISTRY.

Organic Chemistry; a Text-book for Students. Authorized Translation from the Fourth German Edition. Illustrated. *Preparing.*

BLOXAM. CHEMISTRY; Inorganic and Organic. Fifth Edition.

With Experiments. By CHARLES L. BLOXAM, Professor of Chemistry in King's College, London, and in the Department for Artillery Studies, Woolwich. Fifth Edition. With nearly 300 Engravings. Cloth, $3.75; Leather, $4.75

A most complete Text-book for Schools and Colleges.

"Professor Bloxam has given us a most excellent and useful practical treatise. His 666 pages (now 700) are crowded with facts and experiments, nearly all well chosen, and many quite new, even to scientific men . . It is astonishing how much information he often conveys in a few paragraphs. We might quote fifty instances of this."—*Chemical News.*

BLOXAM'S LABORATORY TEACHING. Fourth Edition.

Progressive Exercises in Practical Chemistry. By CHARLES L. BLOXAM, Professor of Chemistry, in King's College, London, etc. Fourth Edition. With 89 Engravings. 12mo. Cloth, $1.75

For Students commencing the study of Practical Chemistry. It contains:—

1. A series of simple Tables for the analysis of unknown substances of all kinds, and for the detection of unknown substances with the aid of the Blowpipe. 2. A brief description of all the practically important single substances likely to be met with in ordinary analysis. 3. Simple directions and illustrations relating to Chemical Manipulation. 4. Short instructions upon the purchase and preparation of the tests. Intended for those who have not access to a laboratory.

STUDENT'S MANUAL OF PHYSICS.

By SYLVANUS P. THOMPSON, B.A., D.S.C., F.R.A.S., Professor of Experimental Physics in University College, Bristol. *Preparing.*

WATTS' MANUAL OF CHEMISTRY.
Physical and Inorganic. By HENRY WATTS, B.A., F.R.S., Editor of the Journal of the Chemical Society; Author of "A Dictionary of Chemistry," etc. With Colored plate of Spectra and 150 other Illustrations. 12mo. 595 pages. Cloth, $2.25

"This work is founded on the well-known Manual of the late Professor Fownes. The work may be characterized as containing a surprising quantity of correct information, clearly expressed and conveniently arranged."—*Chemical News.*

STAMMER. CHEMICAL PROBLEMS.
By KARL STAMMER. Translated, with explanations added, by Prof. W. S. HOSKINSON, Wittenberg College, Springfield, O. 12mo. Cloth, $1.00

VALENTIN. QUALITATIVE CHEMICAL ANALYSIS.
By WM. G. VALENTIN, F.C.S. Revised and edited by W. R. HODGKINSON, PH.D., Professor of Chemistry, Royal Military Academy, and H. M. CHAPMAN, Assistant Demonstrator of Chemistry, South Kensington. Sixth Edition. With numerous Tables, Map of Spectra and other Illustrations. Octavo. Cloth, $3.00

SUTTON'S SYSTEMATIC HANDBOOK OF VOLUMETRIC ANALYSIS; or, the Quantitative Estimation of Chemical Substances by Measure, applied to Liquids, Solids, and Gases. Adapted to the requirements of Pure Chemical Research, Pathological Chemistry, Pharmacy, Metallurgy, Manufacturing Chemistry, Photography, etc., and for the Valuation of Substances used in Commerce, Agriculture, and the Arts. By FRANCIS SUTTON, F.C.S., F.I.C., Public Analyst for the County of Norfolk. Fourth Edition. Revised and Enlarged. With 83 Engravings. Octavo. Cloth, $5.00

ALLEN. COMMERCIAL ORGANIC ANALYSIS.
A Treatise on the Modes of Assaying the Various Organic Chemicals and Products employed in the Arts, Manufactures, Medicine, etc., with Concise Methods for the Detection of Impurities, Adulterations, etc. Second Edition. Revised, enlarged and rearranged. By ALFRED ALLEN, F.C.S.

Vol. I. Alcohols, Ethers, Vegetable Acids, Starch and its Isomers, etc. *Nearly Ready.*

Vol. II. Fixed Oils and Fats, Hydrocarbons and Mineral Oils, Phenols and their Derivatives, Coloring Matters, etc. *In Press.*

Vol. III. Cyanogen Compounds, Alkaloids, Animal Products, etc. *In Press.*

LEFFMANN. ORGANIC AND MEDICAL CHEMISTRY.
A Compend of Organic Chemistry, including Medical Chemistry, Urine Analysis and the Analysis of Water and Food. By HENRY LEFFMANN, M.D., Professor of Chemistry, Pennsylvania College of Dental Surgery, Demonstrator of Chemistry at the Jefferson Medical College, Philadelphia. 12mo.
Cloth, $1.00; Interleaved for the addition of Notes, $1.25

TIDY'S HANDBOOK OF MODERN CHEMISTRY. Organic and Inorganic. By C. MEYMOTT TIDY, M.D. 8vo. Cloth, $5.00

"We doubt if any other chemical work containing so large an amount of information could be procured."—*Dublin Medical Journal.*

WARD'S COMPEND OF CHEMISTRY. Revised Edition.
For Chemical and Medical Students. By G. MASON WARD, M.D., Demonstrator of Chemistry in Jefferson Medical College, Philadelphia. Containing a Table of Elements and Tables for the Detection of Metals in Solutions of Mixed Substances, etc. 12mo.
Cloth, $1.00; Interleaved for the addition of Notes, $1.25

VACHER'S PRIMER OF CHEMISTRY.
Including Analysis. By ARTHUR VACHER. 18mo. Cloth, .50

BERNAY'S NOTES FOR STUDENTS IN CHEMISTRY.
Compiled from Fownes' and other manuals. By ALBERT J. BERNAY, PH.D. Sixth Edition. 12mo. Cloth, $1.25

MUTER'S MEDICAL AND PHARMACEUTICAL CHEMISTRY.
PART ONE.—Theoretical and Descriptive. PART TWO.—Practical and Analytical. By JOHN MUTER, M.D. A Second Edition, Enlarged and Rearranged. The Two Parts bound in one large octavo volume. Cloth, $6.00
PART TWO.—Practical and Analytical. Bound Separately, for the Special Convenience of Students. Large 8vo. Cloth, $2.50

FRANKLAND'S HOW TO TEACH CHEMISTRY.
Six Lessons to Science Teachers. Second Edition. Edited by G. G. CHALONER, F.C.S. Illustrated. *In Press.*

BARTLEY, MEDICAL CHEMISTRY. A Text-book for Medical Students. By E. H. BARTLEY, M.D., Lecturer on Physiological and Practical Chemistry at the Long Island College Hospital. With over 40 Illustrations. 12mo. *Nearly Ready.*

TECHNOLOGICAL BOOKS.

THE BREWER, DISTILLER AND WINE MANUFACTURER.
Giving full Directions for the Manufacture of Beers, Spirits, Wines, Liquors, etc., etc. A Handbook for all interested in the manufacture and sale of Alcohol and Its Compounds. Edited by JOHN GARDNER, F.C.S., Editor of "Cooley's Cyclopedia" and "Beasley's Druggists' Receipt Book." Illustrated. Cloth, $1.75

BLEACHING, DYEING AND CALICO PRINTING.
With Formulæ, a Chapter on Dye Stuffs. By JOHN GARDNER, F.C.S. With Illustrations. 12mo. Cloth, $1.75

ACETIC ACID, VINEGAR, ALUM, AMMONIA; ETC. Their Manufacture, etc. Edited by JOHN GARDNER, F.I.C., F.C.S., assisted by Experts having Practical Knowledge of the Subject treated. Cloth, $1.75

PIESSE, THE MANUFACTURE OF PERFUMERY. 4th Edition.
The Art of Perfumery; or the Methods of Obtaining the Odors of Plants, and Instruction for the Manufacture of Perfumery, Dentifrices, Soap, Scented Powders, Odorous Vinegars and Salts, Snuff, Cosmetics, etc., etc. By G. W. SEPTIMUS PIESSE. Fourth Edition. Enlarged. 366 Illustrations. 8vo. Cloth, $5.50

OVERMAN'S PRACTICAL MINERALOGY.
Mineralogy, Assaying, and Mining, with a Description of the Useful Minerals, etc. By FREDERICK OVERMAN, Mining Engineer. Eleventh Edition. 12mo. Cloth, $1.00

PIGGOTT, ON COPPER.
Copper Mining and Copper Ore. With a full Description of the Principal Copper Mines of the United States, the Art of Mining, etc. By A. SNOWDEN PIGGOTT. 12mo. Cloth, $1.00

PHARMACY AND BOTANY.

BEASLEY'S BOOK OF THREE THOUSAND PRESCRIPTIONS.
Containing over 3100 Prescriptions, collected from the Practice of the most Eminent Physicians and Surgeons—English, French and American; a Compendious History of the Materia Medica, Lists of the Doses of all Officinal and Established Preparations, and an Index of Diseases and their Remedies. By HENRY BEASLEY. Sixth Edition, Revised and Enlarged. Cloth, $2.25

BEASLEY'S DRUGGISTS' GENERAL RECEIPT-BOOK.
Comprising a copious Veterinary Formulary; numerous Recipes in Patent and Proprietary Medicines, Druggists' Nostrums, etc.; Perfumery and Cosmetics; Beverages, Dietetic Articles and Condiments; Trade Chemicals, Scientific Processes, and an Appendix of Useful Tables. Eighth Edition. Cloth, $2.25

BEASLEY'S POCKET FORMULARY AND SYNOPSIS OF THE BRITISH AND FOREIGN PHARMACOPŒIAS.
Comprising Standard and Approved Formulæ for the Preparations and Compounds Employed in Medical Practice. Tenth Edition. 511 pp. 18mo. Cloth, $2.25

TUSON'S VETERINARY PHARMACOPŒIA.
Including the Outlines of Materia Medica and Therapeutics; for the Use of Practitioners and Students of Veterinary Medicine. By RICHARD J. TUSON, Professor of Chemistry, Materia Medica and Toxicology, at the Royal Veterinary College of England. Third Edition. Cloth, $2.50

FLÜCKIGER'S CINCHONA BARKS.
Their History, Botanical and Chemical Characters. Their Uses in the Manufacture of Quinine, etc., etc., with 8 beautifully executed full-page Lithographic plates, accompanied with explanations. By Professor FRIEDRICH FLÜCKIGER, of Strasburg. Translated by FREDERICK B. POWER, PH.D., formerly Professor of Chemistry, Philadelphia College of Pharmacy, now Professor of Materia Medica and Pharmacy, University of Wisconsin. With 8 Lithographic Plates. Royal Octavo. Cloth, $1.50

*** "The Cinchona Barks are perhaps the most prominent medicinal agents now employed, and if the vast sums of money expended in their manufacture and sale be taken into account they are certainly the most important. The questions relating to their origin lead to manifold botanical discussions, while from a chemical point of view quinine, and the other alkaloids which are prepared from them on such a large scale, are of great interest. The history of the Cinchona Barks, and their preparation and manufacture into medicines, are, therefore, subjects of vital interest, not only to the pharmaceutical, but also to the medical profession and to the manufacturers and dealers in their products.

SWERINGEN'S DRUGGISTS' READY REFERENCE BOOK.

A Pharmaceutical Lexicon or Dictionary of Pharmaceutical Science. Containing explanations of the various subjects and terms of Pharmacy, with appropriate selections from the Collateral Sciences. Formulæ for Officinal, Empirical, and Dietetic Preparations, etc., etc. By HIRAM V. SWERINGEN, M.D. 8vo.

Cloth, $3.00; Leather, $4.00

"It is worthy of a welcome, and sure of a ready recognition of its merits."—*London Pharmaceutical Journal.*

"It will prove of great service to the pharmaceutical student, apprentice, pharmacist, druggist and physician, as a book of ready reference and as an aid to the study of scientific works."—*American Journal of Pharmacy.*

BENTLEY AND TRIMEN'S MEDICINAL PLANTS.

PRICE REDUCED.—*In order to bring this Valuable Work more within the reach of Pharmacists, the publishers have determined to reduce the price to* $1.50 *per part, in place of* $2.00, *the old subscription price, and* $75.00 *complete, in* 4 *Vols., half morocco, in place of* $90.00.

Containing full botanical descriptions, with an account of the properties and uses of the principal plants employed in medicine, especial attention being paid to those which are officinal in the British and United States Pharmacopœias. The plants which supply food and substances required by the sick and convalescent are also included. By R. BENTLEY, F.R.S., Professor of Botany, King's College, London, and H. TRIMEN, M.B., F.H.S., Department of Botany, British Museum. Each species illustrated by a colored plate drawn from nature. In Forty-two parts. Eight colored plates in each part. Price $1.50 each, or handsomely bound in 4 volumes, Half Morocco, $75.00

"It is an indispensable work of reference to every one interested in pharmaceutical Botany."—*London Pharmaceutical Journal.*

"This work may be recommended as a most useful one to druggists, and all who desire to be familiar with the Botany of Medicinal Plants."—*Druggists' Circular.*

"The work when complete (it is now complete) will be the most valuable compend of Medical Botany ever published."—*Boston Journal of Chemistry.*

BIDDLE'S MATERIA MEDICA. Ninth Edition.

Materia Medica. For the Use of Students and Physicians. By the late Prof. JOHN B. BIDDLE, M.D., Professor of Materia Medica in Jefferson Medical College, Philadelphia. The Ninth Edition, thoroughly revised, and in many parts rewritten, by his son, CLEMENT BIDDLE, M.D., Assistant Surgeon, U. S. Navy, assisted by HENRY MORRIS, M.D. Containing all the additions and changes made in the last revision of the United States Pharmacopœia. The Botanical portions have been curtailed or left out, and the other sections, on the Physiological action of Drugs, greatly enlarged. Octavo. Cloth, $4.00; Leather, $4.75

"The additions are valuable, and we must congratulate the author upon having improved what was already so useful a work, both to the student and physician."—*Phila. Medical and Surgical Reporter.*

"It has been the design of the author to present in his work a text-book for the student. It is brief, and yet sufficiently comprehensive. His style is clear and yet succinct. He covers the ground—covers it well, and cumbers his work with nothing superfluous."—*Atlanta Medical and Surgical Journal.*

"One thing that particularly recommends this work to the student is, that the book is not so large as to discourage and cause him to feel that it is impossible for him to get over it and so much else in the short time before him."—*St. Louis Medical and Surgical Journal.*

"It contains, in a condensed form, all that is valuable in materia medica, and furnishes the medical student with a complete manual on this subject."—*Canada Lancet.*

PROCTER'S LECTURES ON PRACTICAL PHARMACY.

By Prof. BERNARD S. PROCTER. Second Edition, with additions and corrections. 44 Wood Engravings and 32 Fac-simile Prescriptions. Octavo. Cloth, $4.50

ROBERTS' MATERIA MEDICA AND PHARMACY.

Containing many Valuable Tables. Directions for Preparing, with the Constituents of, numerous Modern and Useful Preparations, Extracts, etc., etc. By FREDERICK ROBERTS, Examiner of Materia Medica and Pharmacy in the University of London, etc., etc. 12mo. Cloth, $2.00

MERRELL'S DIGEST OF MATERIA MEDICA AND PHARMACY.

Forming a complete Pharmacopœia for the Use of Physicians, Druggists and Students. By ALBERT MERRELL, M.D., Member of the State Board of Health of Missouri; Professor of Chemistry, Pharmacy and Toxicology in the American Medical College, St. Louis. Octavo, 512 pages. Half dark Calf, Red edges, $4.00

The author of this volume, who has had unusual experience as manufacturing chemist, analyst, teacher and physician, presents in this digest, as the result of his study and observation, such information pertaining to the composition, pharmacy and therapeutic applications of each drug used by American physicians, as is needed for its employment and manufacture. The book has been designed to meet a want which is becoming more expressed each day, for a manual as complete, yet more condensed and therefore easier for reference, than a Dispensatory, more exhaustive than the Pharmacopœia, and containing in a limited space the elements of a text-book on materia medica and pharmacy, at once useful to the druggist and physician.

"In clearness of style, simplicity of classification, and preciseness of directions, the treatise is indeed a model, and will be found alike instructive and useful for the physician and druggist."—*American Chemical Review.*

"It is really the most modern of works; its terseness is commendable; its synoptical and directness of arrangement lends worth to the practitioner, dispensing pharmacist and the reviewer."—*St. Louis Medical Journal.*

PEREIRA'S PHYSICIANS' PRESCRIPTION BOOK. 16th Edition.

Containing Lists of Terms, Phrases, Contractions and Abbreviations used in Prescriptions, Explanatory Notes, Grammatical Construction of Prescriptions, Rules for the Pronunciation of Pharmaceutical Terms, etc. By JONATHAN PEREIRA, M.D. Sixteenth Edition. Cloth, $1.00; Leather with Tucks and Pockets, $1.25

OLDBERG. PRESCRIPTION BOOK. 300 New Prescriptions.

Three Hundred Prescriptions, Selected Chiefly from the Best Collections of Formulæ used in Hospital and Out-patient-practice, with a Dose Table, and a Complete Account of the Metric System. By OSCAR OLDBERG, PHAR.D., Late Medical Purveyor, United States Marine Hospital Service; Professor of Materia Medica, National College of Pharmacy, Washington, D. C.; Member of the American Pharmaceutical Association, and of the Sixth Decennial Committee of Revision and Publication of the Pharmacopœia of the United States. 12mo. Paper Covers, .75; Cloth, $1.25

The prescriptions given in this work are selected from the Pharmacopœias and formularies of the great Hospitals of New York, Philadelphia, Boston and London, or contributed from the practice of medical officers of the United States Service. The Dose Table includes nearly all of the remedies that have a place in the current *Materia Medica.*

WYTHE'S DOSE AND SYMPTOM BOOK. Eleventh Edition.
The Physician's Pocket Dose and Symptom Book. Containing the Doses and Uses of all the Principal Articles of the Materia Medica, and Original Preparations. Eleventh Revised Edition.
Cloth, $1.00; Leather, with Tucks and Pocket, $1.25

"The chapter on Dietetic Preparations will be found useful to all practicing physicians, most of whom have but little acquaintance with the mode of preparing the various articles of diet for the sick."—*Boston Medical and Surgical Journal.*

"Many a hard-worked practitioner will find it a useful little work to have on his study table."—*Canada Medical and Surgical Journal.*

A PHARMACOPŒIA OF SELECTED REMEDIES, with Therapeutic Annotations, Notes on Alimentation in Disease, Air, Massage, Electricity and other Supplementary Remedial Agents; and a Clinical Index; arranged as a Handbook for Prescribers. By EDMUND A. KIRBY, M.D. Sixth Edition, Revised and Enlarged. With Illustrations. Cloth, $2.25

BY THE SAME AUTHOR.

ON THE VALUE OF PHOSPHORUS AS A REMEDY FOR LOSS OF NERVE POWER, MELANCHOLIA, NEURALGIA and other Functional Disorders of the Nervous System induced by Overwork and the Exigencies of Modern Life. With Formulæ and Directions for Treatment. Fifth Edition. Octavo. Boards, $1.00

TANNERS' MEMORANDA OF POISONS and their Antidotes and Tests. Fifth American, from the Last London Edition. Revised and Enlarged. Cloth, .75

This most complete Toxicological Manual should be within reach of all physicians and pharmacists, and as an addition to every family library, would be the means of saving life and allaying pain when the delay of sending for a physician would prove fatal.

MEDICAL LEXICONS.

LONGLEY. POCKET MEDICAL LEXICON.
Students' Pocket Medical Dictionary, Giving the Correct Definition and Pronunciation of all Words and Terms in General Use in Medicine and the Collateral Sciences, with an Appendix, containing Poisons and their Antidotes, Abbreviations Used in Prescriptions, and a Metric Scale of Doses. By ELIAS LONGLEY. 24mo.
Cloth, $1.00; Tucks and Pocket, $1.25

"This little book will be welcomed by students in medicine and pharmacy as a convenient pocket companion, giving the pronunciation, acceptation, and definition of medical, pharmaceutical, chemical and botanical terms."—*American Journal of Pharmacy.*

CLEAVELAND. POCKET DICTIONARY.
A Pronouncing Medical Lexicon, containing correct Pronunciation and Definition of terms used in medicine and the collateral sciences. By C. H. CLEAVELAND, M.D. Thirty-first Edition. 16mo.
Cloth, 75 cents; Tucks with Pocket, $1.00

This is a most convenient size for the pocket, and contains all the principal words in use, together with rules for pronunciation, abbreviations used in prescriptions, list of poisons, their antidotes, etc.

THE MICROSCOPE.

BEALE'S HOW TO WORK WITH THE MICROSCOPE. 5th Ed.

A Complete Manual of Microscopical Manipulation, containing a full description of many new processes of investigation, with directions for examining objects under the highest powers, and for taking photographs of microscopic objects. Fifth Edition. Containing over 400 Illustrations, many of them colored. 8vo. Cloth, $7.50

"The Encyclopædic character of Dr. BEALE'S well known work on the *Microscope* renders it impossible to present an abstract of its contents; suffice it to say, that anything in his department upon which the physician can desire such information will be found here, and much more in addition. It is, moreover, a storehouse of facts, most valuable to the physician, and is indispensable to every one who uses the microscope."—*American Journal of Medical Science.*

BEALE'S USE OF THE MICROSCOPE IN PRACTICAL MEDICINE. Fourth Edition.

For Students and Practitioners, with full directions for examining the various secretions, etc., in the Microscope. Fourth Edition. 500 Illustrations. Much enlarged. 8vo. Cloth, $7.50

"As a microscopical observer, and a histological manipulator, his (Dr. BEALE) skill and eminence are generally conceded."—*Popular Science Monthly.*

CARPENTER ON THE MICROSCOPE. Sixth Edition.

The Microscope and its Revelations. By W. B. CARPENTER, M.D., F.R.S. Sixth Edition. Revised and Enlarged, with over 500 Illustrations. Several Lithographic Plates. Cloth, $5.50

"As a text-book of Microscopy in its special relation to natural history and general science, the work before us stands confessedly first, and is alone sufficient to supply the wants of the ordinary student."—*American Journal of Microscopy.*

MACDONALD'S MICROSCOPICAL EXAMINATION OF WATER AND AIR.

A Guide to the Microscopical Examination of Drinking Water, with an Appendix on the Microscopic l Examination of Air. By J. D. MACDONALD, M.D. With Twenty-five Full-page Lithographic Plates, Reference Tables, etc. Second Edition, 8vo. Cloth, $2.75

THE MICROTOMIST'S VADE-MECUM.

A Handbook of the methods of Microscopic Anatomy, comprising upwards of Five Hundred Formulæ and Methods, collected from the practice of the best workers. By ARTHUR BOLLES LEE. Crown 8vo. Cloth, $3.00

WYTHE, ON THE MICROSCOPE.

The Microscopist. A Manual of Microscopy and Compendium of the Microscopic Sciences, Micro-Mineralogy, Micro-Chemistry, Biology, Histology, and Practical Medicine. By JOSEPH H. WYTHE, A.M., M.D. Fourth Edition. 252 Illustrations. 8vo.
Cloth, $3.00; Leather, $4.00

An Index and Glossary, with notices of recent additions to the microscope, together with the genera of microscopic plants, have been given in an Appendix.

"The author very carefully brings out every necessary fact and principle relating to the use of the microscope, and now that this instrument has become an essential part of every practitioner's armamentarium, a practical guide and reference book is also a necessity, and we are fully warranted in reiterating the statement that this is one of the most valuable text-books ever offered to students and practitioners of medicine."—*The Cincinnati Lancet and Clinic.*

MARTIN'S MANUAL OF MICROSCOPIC MOUNTING.

With Notes on the Collection and Examination of Objects, and upwards of 150 Illustrations. By JOHN H. MARTIN. Second Edition, Enlarged. 8vo. Cloth, $2.75

INDIGESTION, HEALTH, HEADACHES, ETC.

BEALE ON SLIGHT AILMENTS. New Edition. Just Ready.

Slight Ailments, Their Nature and Treatment. By LIONEL S. BEALE, M.D., F.R.S., Professor of Practice, King's Medical College, London. Second Edition. Enlarged and Illustrated.

Cloth, $1.25; Paper Covers, .75

Better Edition, Heavy Paper. Extra Cloth, $1.75

OUTLINE OF CONTENTS.

Introductory. The Tongue in Health and Slight Ailments. Appetite. Nausea. Thirst. Hunger. Indigestion, its Nature and Treatment. Constipation, its Treatment. Diarrhœa. Vertigo. Giddiness. Biliousness. Sick Headache. Neuralgia. Rheumatism. The Feverish and Inflammatory State. Of the Actual Changes in Fever and Inflammation. Slight Inflammations, etc., etc.

"A valuable work for the family library."—*Boston Transcript.*

"Clear, practical and a valuable instructor."—*Baltimore Gazette.*

"An admirable treatise upon the minor ills which flesh is heir to."—*Springfield Republican.*

GILL. ON INDIGESTION. Third Edition.

Indigestion: What It Is; What It Leads To; and a new Method of Treating it. By JOHN BEADNELL GILL, M.D. Third Edition. 12mo. Cloth, $1.25

DAY ON HEADACHES. Fourth Edition.

The Nature, Causes, and Treatment of Headaches. Fourth Edition. Illustrated. By WM. HENRY DAY, M.D. Octavo.

Paper Covers, 75 cents; Cloth, $1.25

"Well worth reading. The remarks on treatment are very sensible."—*Boston Medical and Surgical Journal.*

EDWARDS. BRIGHT'S DISEASE. New Edition.

How a Person Affected with Bright's Disease Ought to Live. By JOS. F. EDWARDS, M.D. Second Edition. Cloth, .50

"Physicians, as well as laymen, will find the work interesting, and will obtain many valuable hints as to the proper hygiene to be observed in this disease."—*Cincinnati Medical News.*

BY SAME AUTHOR.

CONSTIPATION. Plainly Treated and Relieved Without the Use of Drugs. Second Edition. Cloth, .50

MALARIA. What It Means; How to Escape It; Its Symptoms; When and Where to Look for It. Cloth, .50

VACCINATION AND SMALLPOX.

Showing the Reasons in favor of Vaccination, and the Fallacy of the Arguments Advanced against it, with Hints on the Management and Care of Smallpox patients. Price, .50

These are invaluable little treatises upon subjects that enter painfully into the life experiences of a large majority of the human family. Dr. Edwards shows not only how they may be avoided, but in plain and simple language he tells those already afflicted with them how they may find relief.

The above Four Volumes bound in One. Cloth, $1.50

DULLES, ACCIDENTS.

What to Do First, In Accidents and Poisoning, and other household emergencies. By C. W. DULLES, M.D. Second Edition, Enlarged, with many Illustrations. Cloth, .75

"The instructions in regard to the treatment of injuries and sudden illnesses are thoroughly practical, and the suggestions for supplies for emergencies are especially useful."—*New York Tribune.*

"It ought to be read once or twice each year."—*St. Louis Medical and Surgical Journal.*

"It is a book which no family ought to be without."—*Boston Herald.*

WRIGHT, ON HEADACHES. Ninth Thousand.

Headaches, their Causes, Nature and Treatment. By HENRY G. WRIGHT, M.D. 12mo. Cloth, .50

MACKENZIE ON HAY FEVER.

Its Treatment, etc. By MORELL MACKENZIE, M.D. Paper, .50

BENNETT ON NUTRITION IN HEALTH AND DISEASE.

A Contribution to Hygiene. By J. HENRY BENNETT, M.D. Third Edition, Revised and Enlarged. Cloth, $2.50

POTTER ON SPEECH, AND ITS DEFECTS.

Considered Physiologically, Pathologically, Historically, and Remedially; being the Lea Prize Thesis of Jefferson Medical College, 1882. Revised and Corrected for Publication. 12mo. Cloth, $1.00

CARTER'S EYESIGHT, GOOD AND BAD. New Edition.

A Treatise on the Exercise and Preservation of the Eyes. By ROBERT B. CARTER, F.R.C.S. Second Edition, with 50 Illustrations. Test Types, etc. 12mo. Paper, .75; Cloth, $1.25

"There is much wholesome advice given on the 'Care of the Eyes in Infancy and Childhood,' and on this account, if no other, the book should be in the hands of every parent and teacher."—*St. Louis Courier of Medicine.*

HEALTHY SKIN. Eighth Edition. A Practical Treatise on the Skin and Hair; their Preservation and Management. By ERASMUS WILSON, M.D., F.R.S. Eighth Edition. 12mo. Paper. Price, $1.00

HUFELAND, LONG LIFE.

The Art of Prolonging Life. By C. W. HUFELAND. Edited by ERASMUS WILSON, M.D. 12mo. Cloth, $1.00

"We wish all doctors and all their intelligent clients would read it, for surely its perusal would be attended with pleasure and benefit."—*American Practitioner.*

MISCELLANEOUS.

ARMATAGE'S VETERINARIANS' POCKET REMEMBRANCER.

Containing concise directions for the Treatment of Urgent or Rare Cases, embracing Semeiology, Diagnosis, Prognosis, Surgery, Therapeutics, Detection of Poisons, Hygiene, etc., of the Horse. New Revised Edition. 18mo. Cloth, $1.25

ANSTIE, STIMULANTS AND NARCOTICS.

With special researches on the Action of Alcohol, Ether and Chloroform on the Vital Organism. By FRANCIS E. ANSTIE, M.D. 8vo. Cloth, $3.00

YEO'S MANUAL OF PHYSIOLOGY.

A Text-book for Students. By GERALD F. YEO, M.D., F.R.C.S., Professor of Physiology in King's College, London. With over 300 carefully printed Illustrations. A Complete Glossary and Index. Crown Octavo. Cloth, $4.00 ; Leather, $5.00

"We have pleasure in recommending this book, as a most excellent manual, being what it pretends to be—elementary, and yet containing all that is really of importance to the student."—*Medical Times and Gazette.*

"There are many points in physiology that are either not comprehended or are misunderstood by the great majority of students. In this work these points are made especially clear. We have had long experience in teaching this branch of medical science, and unreservedly commend this work to the student of physiology."—*Archives of Dentistry.*

"For students' use it is one of the very best text-books in Physiology."—*Prof. L. B. How, Dartmouth Medicol College, Hanover, N. H.*

KANE. THE OPIUM, MORPHINE AND SIMILAR HABITS.

Drugs that Enslave. The Opium, Morphine, Chloral, Hashisch and Similar Habits. By H. H. KANE, M.D., of New York. With Illustrations. Paper, .75 ; Cloth, $1.25

MILLER, ON ALCOHOL.

Alcohol. Its Place and Power. By JAMES MILLER. Cloth, .50

LIZARS, ON TOBACCO.

The Use and Abuse of Tobacco. By JOHN LIZARS, M.D. Cl., .50

The above Two Volumes bound in One. Cloth, $1.00

PARRISH. ALCOHOLIC INEBRIETY.

Alcoholic Inebriety from a Medical Standpoint, with Illustrative Cases from the Clinical Records of the Author. By JOSEPH PARRISH, M.D., President of the American Association for the Cure of Inebriates. 12mo. Paper Covers, .75 ; Cloth, $1.25

ACTON. THE REPRODUCTIVE ORGANS.

The Functions and Disorders of the Reproductive Organs in Childhood, Youth, Adult Age and Advanced Life, considered in their Physiological, Social and Moral Relations. By WILLIAM ACTON, M.D., M.R.C.S. Sixth Edition. 8vo. Cloth, $2.00

"In the work now before us, all essential detail upon its subject matter is clearly and scientifically given. We recommend it accordingly, as meeting a necessary requisition of the day, refusing to join in that opinion which regards the consideration of the topics in question as beyond the duties of the medical practitioner."—*The London Lancet.*

RYAN'S PHILOSOPHY OF MARRIAGE.

In its Social, Moral and Physical Relations, and Diseases of the Urinary Organs. By MICHAEL RYAN, M.D., Member of the Royal College of Physicians, London. 12mo. Cloth, $1.00

WALKER ON INTERMARRIAGE.

Or, The Mode in which, and the Causes why, Beauty, Health and Intellect result from certain Unions; and Deformity, Disease and Insanity from others. Illustrated. 12mo. Cloth, $1.00

MATHIAS. LEGISLATIVE MANUAL.

A Rule for Conducting Business in Meetings of Societies, Legislative Bodies, Town and Ward Meetings, etc. By BENJ. MATHIAS, A.M. Sixteenth Edition. 16mo. Cloth, .50

HOSPITALS AND NURSING.

BURDETT'S PAY HOSPITALS AND PAYING WARDS throughout the World. Facts in support of a rearrangement of the system of Medical Relief. By HENRY C. BURDETT. 8vo. Cloth, $2.25

"Mr. Burdett displays and discusses the whole scheme of Hospital accommodation with a comprehensive understanding of its nature and extent."—*American Practitioner.*

BURDETT'S COTTAGE HOSPITALS.
General, Fever, and Convalescent; their Progress, Management, and Work. Second Edition, rewritten and much Enlarged, with many Plans and Illustrations. Crown 8vo. Cloth, $4.50

"Mr. Burdett's book contains a mass of information, statistical, financial, architectural, and hygienic, which has already proved of great practical utility to those interested in cottage hospitals, and we can confidently recommend this second edition to all who are in search of the kind of information which it contains."—*Lancet.*

DOMVILLE, ON NURSING.
A Manual for Hospital Nurses and others engaged in attending to the sick. Fourth Edition. With Recipes for Sick Room Cookery, etc. Cloth, .75

CULLINGWORTH'S MANUAL OF NURSING. Illustrated.
Medical and Surgical. By CHARLES J. CULLINGWORTH, M.D., Physician to St Mary's Hospital, Manchester, England. Second Edition. With eighteen Illustrations. 12mo. Cloth, $1.00

BY THE SAME AUTHOR.

CULLINGWORTH'S MANUAL FOR MONTHLY NURSES.
Cloth, .50

RECORD FOR THE SICK ROOM.
Designed for the use of Nurses and others engaged in caring for the sick. It consists of Blanks, on which may be recorded the Hour, State of Pulse, Temperature, Respiration, Medicines to be given, Nourishment taken, Special Memoranda, etc., etc., with a list of directions for the nurse in emergencies, together with other Practical Information, and a Temperature Chart for the use of the physician. By the use of this form, the nurse can, at a glance, recall the Physician's Directions instead of trusting to her memory; and the physician can, by consulting it, obtain correct information about the state of his patient between visits. *Sample Pages Free.*
Paper Covers, 25 cents. Per Dozen, $2.50

HYGIENE.

PARKE'S PRACTICAL HYGIENE. Sixth Edition.
A Manual of Practical Hygiene. By EDWARD A. PARKES, M.D. The Sixth Revised and Enlarged Edition. With Many Illustrations. 8vo. Cloth, $3.00

"It is the most complete work on Hygiene which we have seen."—*New York Medical Record.*

"It never fails to throw light on any hygienic question which may be proposed."—*Boston Medical and Surgical Journal.*

"We commend the book heartily to all needing instruction in Hygiene."—*Chicago Medical Journal.*

WILSON'S TEXT-BOOK OF DOMESTIC HYGIENE AND SANITARY INFORMATION.

A Guide to Personal and Domestic Hygiene. By GEORGE WILSON, M.D., Medical Officer of Health, etc. Edited by JOS. G. RICHARDSON, M.D., Professor of Hygiene at the University of Pennsylvania. 314 pages. 12mo. Cloth, $1.00

CHAPTER I.—Introductory, page 17. II. The Human Body, 33. III. Causes of Disease, 66. IV. Food and Diet, 119. V. Cleanliness and Clothing, 169. VI. Exercise, Recreation and Training, 187. VII. Home and Its Surroundings, Drainage, Warming, etc., 221. VIII. Infectious Diseases and their Prevention, 269.

"A most useful, and in every way, acceptable book."—*New York Herald.*

"Marked throughout by a sound, scientific spirit, and an absence of all hasty generalizations, sweeping assertions, and abuse of statistics in support of the writer's particular views. . . . We cannot speak too highly of a work which we have read with entire satisfaction."—*Medical Times and Gazette.*

BIBLE HYGIENE;

Or, Health Hints. By a Physician. This book has been written, first, to impart in a popular and condensed form the elements of Hygiene; second, to show how varied and important are the Health Hints contained in the Bible, and third, to prove that the secondary tendency of modern Philosophy runs in a parallel direction with the primary light of the Bible. 12mo. Paper, .50; Cloth, $1.00

"The scientific treatment of the subject is quite abreast of the present day, and is so clear and free from unnecessary technicalities that readers of all classes may peruse it with satisfaction and advantage."—*Edinburgh Medical Journal.*

CORFIELD. DWELLING HOUSES.

The Sanitary Construction and Arrangement of Dwelling Houses. By W. H. CORFIELD, M.A., M.D. Enlarged Edition, with Plans and Illustrations. 12mo. Cloth, $1.25

WILSON, ON DRAINAGE.

Drainage for Health; or, Easy Lessons in Sanitary Science, with Numerous Illustrations. By JOSEPH WILSON, M.D., Medical Director United States Navy. One Vol. Octavo. Cloth, $1.00

"Dr. Wilson is favorably known as one of the leading American writers on hygiene and public health. The book deserves popularity."—*Medical and Surgical Reporter.*

"Attention to its teachings may save much disease and perhaps many lives."—*Cincinnati Gazette.*

"Will be sure to be a harbinger of good in every family whose good fortune it may be to possess a copy."—*Builder and Wood Worker.*

BY SAME AUTHOR.

NAVAL HYGIENE.

Naval Hygiene, or, Human Health and Means for Preventing Disease. With Illustrative Incidents derived from Naval Experience. Illustrated. Second Edition. 8vo. Cloth, $3.00

SEPULTURE:

Its History, Methods, and Sanitary Requisites. By STEPHEN WICKES, A.M., M.D. Octavo. Cloth, $1.50

Introduction. History of Sepulture. Ancient Customs and Methods. Sepulchres. Interments Among the Greeks. Customs Among the Romans. Persian Burial. North American Indian Burial. Early Christian Burial. Animal Putrescence. Malignant Disease from one Corpse. Saturated Soil of a Graveyard Disturbed. Intra-Mural Interment in the United States. Yellow Fever. Asiatic Cholera. Pestilence. Rural Cemeteries. Coffins for the Dead. Country Graveyards.

WILSON'S HANDBOOK OF HYGIENE
And Sanitary Science. By GEORGE WILSON, M.D., Fellow of the Sanitary Institute of Great Britain, Medical Officer of Health, etc., etc. With Illustrations. Fifth Edition. Revised and Enlarged. 8vo. Cloth, $2.75

FRANKLAND'S WATER ANALYSIS,
For Sanitary Purposes, with Hints for the Interpretation of Results. By E. FRANKLAND, F.R.S. Illustrated. Cloth, $1.00

"The author's world-wide reputation will commend this manual to all sanitarians, and they will not be disappointed in finding all the essentials of the important subject of which it treats."—*The Sanitarian.*

FOX'S WATER, AIR AND FOOD.
Sanitary Examinations of Water, Air and Food. By CORNELIUS B. FOX, M.D. 94 Engravings. 8vo. Cloth, $4.00

HEALTH RESORTS.

MADDEN'S HEALTH RESORTS FOR CHRONIC DISEASES.
A Handbook, the result of the author's own observations during several years of health travel in many lands, containing also remarks on climatology and the use of mineral waters. By T. M. MADDEN, M.D. 8vo. Cloth, $2.50

WILSON'S SEA VOYAGES FOR HEALTH.
A Handbook of Practical Information as to Sea Voyages, for the Use of Tourists and Invalids. By WM. S. WILSON, M.D. With a Chart showing the Ocean Routes, and Illustrating the Physical Geography of the Sea. Crown 8vo. Cloth, $2.50

SOLLY'S COLORADO SPRINGS AND MANITOU AS HEALTH RESORTS. By S. EDWIN SOLLY, M.D., M.R.C.S., Eng., including an article descriptive of the scenery and resources of the State. 12mo. Paper Covers, .25

THE CARE OF CHILDREN.

HALE. ON THE MANAGEMENT OF CHILDREN IN HEALTH AND DISEASE.
A Book for Mothers. By MRS. AMIE M. HALE, M. D. Abounding in valuable information and common sense advice. New Enlarged Edition. 12mo. Cloth, .75

"We shall use our influence in the introduction of this work to families under our care, and we urge the profession generally to follow our example."—*Buffalo Medical and Surgical Journal.*

CHAVASSE ON THE MENTAL CULTURE AND TRAINING OF CHILDREN. By PYE HENRY CHAVASSE.
Paper Covers, .50 cents; Cloth, $1.00

WHAT EVERY MOTHER SHOULD KNOW. By EDWARD ELLIS, M.D., author of Diseases of Children, etc. Cloth, .75

"It is only too true that our children have to dodge through the early part of life as through a labyrinth. We must be thankful to meet with such a sensible guide for them as Dr. Ellis."—*Pall Mall Gazette.*

☞ The above Three Volumes in One, Cloth, $1.50